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Psychological Monographs

Memory Defects in the Organic Psychoses

An Experimental Study

BY

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INTRODUCTION

It is a well known fact that more or less marked memory defects appear in the organic psychoses. In general paresis the incipient symptoms include memory defects which in subsequent stages develop into utter failure of memory. There is loss of memory in senile dementia and in arterio-sclerosis, as also in Korsakow's psychosis. The memory is noticeably affected in alcoholic dementia and in other toxic psychoses, in the psychoses associated with cerebral syphilis and apoplexy, in epileptic dementia, myxoedema, and so forth. Subjects will be found who are unable to remember practically the whole of their past life. Others, while retaining memory of the more remote past, have lost totally or almost totally the memory of the more immediate past, usually of the period introduced by the advent of their brain disease or lesion. Some thus afflicted remember certain events, they know their name and age and are oriented in regard to time, place, and persons surrounding them, while others show a more or less profound ignorance even of these things.

It is possible, then, to give a fairly accurate clinical description of the memory defects associated with organic psychoses by classifying them as circumscribed or general, retrograde or anterograde amnesias.[1]

Knowledge of the more intimate nature of these memory defects may be hoped for only through experimental investigation. The quantity of work done to date in this field has been very meager. In 1913 Boring published a monograph on *Learning in Dementia Precox*.[2] His experiments included tests of attention, tests of memory span with digits presented both orally and visually, the Heilbronner apperception test, kinaesthetic memory tests, cancellation and maze tests. His primary object was to establish the subjects' facility for learning. Hart and Spearman published an account of *Mental Tests of Dementia* in 1915.[3]

[1] White, William A. *Outline of Psychiatry,* 1919, p. 78.
[2] *Psychol. Monog.,* June, 1913, Vol. XV.
[3] *J. Abnor. Psychol.,* 1914-15, Vol. IX, pp. 217 et seq.

They employed the method of paired associations and cancellation tests. In a study of the correlation between memory and perception Moore experimented on a number of inmates of asylums suffering from paresis, senile dementia, Korsakow's psychosis, chronic alcoholism and paralysis.[4] He found a general tendency for both memory and perception to deteriorate together, although in some cases one of these functions was affected without the other. In 1920 Dr. Achilles published a monograph on *Experimnetal Studies in Recall and Recognition* containing a chapter on memory tests of insane patients.[5] The subjects represented the Korsakow psychosis, general paralysis, arterio-sclerosis, senile dementia, cerebral syphilis, and undifferentiated psychoses. The general results of this study are that "there is little difference in recall among the patients suffering from general paralysis and arterio-sclerosis. In recognition, there is no difference except in the case of words for which the arterio-sclerosis patients score higher. (Omitting one patient who was recovering) one finds the scores among the Korsakoffs lower than those among the general paralysis and arterio-sclerosis cases. These patients were less able to attempt the tasks. There is no striking difference between the way the diseases affect recall and recognition."[6]

The psychological problems in the memory defects associated with organic psychoses are complex. Memory depends upon two factors, apprehension and retention. Moreover, as Kennedy and others point out, there are two "phenomena" of memory, recognition and reproduction. We distinguish memory according to the sense organs involved, thus we speak of visual, auditory, and kinaesthetic memory. A further distinction is made between immediate and mediate memory. The span of memory, or the number of items which can be remembered, enters as a factor in connection with apprehension and retention. Three general condi-

[4] Moore, Thomas Vernon, *The Correlation between Memory and Perception in the Presence of Diffuse Cortical Degeneration. Psychol. Monog.*, 1919, No. 120.

[5] *Archives of Psychol.*, 1920, No. 44.

[6] *Op. cit.*, p. 64.

tions influence the memory of past experiences, recency, vividness, and frequency. That of recency partly relates to the factor of retention, partly to the order or place in which an item is presented in a series. Vividness implies more than mere intensity of the stimulus, it is also concerned with the mental attitude of the subject. Frequency is measured in the number of times a stimulus is repeated. These various factors, "phenomena," kinds of memory, and conditions must be considered separately to determine more exactly the nature of memory defects.

The present investigation was confined to anterograde amnesia, or the inability of the subject to store up memories. Moreover, it was limited chiefly to visual memory; nevertheless a certain measure of comparison was provided by employing on the one hand material for visual together with auditory and kinaesthetic memory, and on the other material for only visual and kinaesthetic memory. The two kinds of material also provided for the distinction between immediate and mediate memory. Reproduction was limited to the method of verbal recall.

The questions which the present investigation has aimed to answer may be summarized as follows. Is the amnesia due to faulty apprehension, faulty retention, or to both? To what degree does the defect affect recognition and reproduction respectively? What is the relation of the defect to different kinds of visual stimuli? Does the defect affect the span of memory? What is the influence of primacy and recency, vividness, and frequency respectively on the memory of the defective? Does the memory defect manifest itself similarly in different individuals? How does the memory of the defective compare with that of "normal" individuals?

I. PRELIMINARY EXPERIMENTS

The material used in the preliminary experiments consisted of half-tone pictures and of irregular figures, mounted on cards 3½″ x 4″ and arranged in pairs so that the two cards of a pair were similar without being alike. Three, five, or more cards of different pairs were presented in succession, about one second each, with intervals of about two seconds, and the subject selected those he had seen from a simultaneous exposure of the shown cards with the remaining cards of the same pairs. Further description of material and method will be found in the section on method (pp. 8 *et seq.*). Three subjects, McG, E-n, and H-n were employed.

1. Span of Memory

A number of tests were made to find the approximate number of cards to the set which could be recognized immediately after presentation with a proportion of error suitable for experimental purposes.

Experiments with Pictures. McG obtained better results with 5 than with 3 cards to the set, 20 tests with 5-card sets giving 66 R., 1 H. R., 3 H. W., 3 W., and 2 N. from 75 T.[1] In the first five the results were lower than in the remaining tests, due doubtlessly to the subject's lack of familiarity with the experiment.

E-n obtained better results with 3 than with 5 cards to the set, 16 tests with 3-card sets giving 81 per cent R. and 10 tests with 5-card sets 66 per cent R. In the latter tests the score was 33 R., 2 H.R., 2 H.W., 3 W., and 10 N. from 50 T.

H-n. Tests with 5-card sets resulted in only right selections. In 10 tests with 10-card sets the score was 92 R., 2 H.W., 4 W., and 2 N. from 100 T.

[1] The letters, to be used in subsequent tables, signify:—R. right, W. wrong, N. no selection; H.R. right after hesitation, H.W. wrong after hesitation; T. total number of cards exposed.

Experiments with Figures. The figures consisted of four kinds of material, black irregular and colored irregular figures, straight lines, and ink blots. Each kind formed a separte series.

McG. Results with 3-card sets were superior to those obtained with 5-card sets. Ink blots and straight lines gave equal results, superior to those with colored figures; the lowest results were obtained with black figures. In experiments with 5-card sets including 5 tests for each kind of material, the score was 48 R., 3 H.R., 2 H.W., 40 W., and 7 N. from 100 T.

H-n. In 10 tests with 5-card sets of colored figures the score was 38 R. and 12 W. from 50 T., and in 5 tests with 10-card sets of straight lines 35 R. and 15 W. from 50 T.

These results, although obtained for the purpose of making suitable selection for the main part of the work, indicate that the span of memory varies greatly with different individuals and in less degree with different materials for the same individual.

2. Retention

A series of tests were made for recognition with a short period of time elapsing between presentation and selection. This interval was counted from the exposure of the last card in a series.

Experiments with Pictures. McG. 5-card sets were used. 10 tests with an interval of 30″ between exposure and selection resulted in 41 R. and 9 W. from 50 T. 10 additional tests were made, five with an interval of 30″ and five with an interval of 60″ between exposure and selection. The results were:—with 30″ interval 15 R., 2 H. R., 6 W., and 2 N. from 25 T., and with 60″ interval 20 R. and 5 W. from 25 T. In the 20 tests there is a total of 76 per cent R. The immediate recognition tests, with exclusion of the first five which served to familiarize the subject with the experiments, gave 88 per cent R. The difference is 12 per cent R. The increase in the interval between exposure and selection from 30″ to 60″ did not reduce the results.

E-n. 10 tests were made with 5-card sets and with an interval of 60″ between exposure and selection. The number of R. was the same as for immediate recognition.

H-n. Tests with 5-card sets and with an interval of 60″ be-

tween exposure and selection resulted in only right selections. 5 tests with 10-card sets and with an interval of 60″ gave 86 per cent R. as against 92 per cent R. in the immediate recognition tests.

Experiments with Figures. McG. In tests with 3-card sets and with an interval of 60″ between exposure and selection the results were inferior to those obtained in immediate recognition tests. In experiments with 5-card sets including 5 tests for each kind of material the score was 54 R. and 46 W. from 100 T. Comparing this score with that in immediate recognition we find that the former is higher by 6 per cent both in R. and in W., with an absence of other than R. and W. selections.

H-n was tested only for colored figures. 10 tests of 5 cards each and with an interval of 60″ between exposure and selection gave 38 R. and 12 W. from 50 T. which is identical with the result in the corresponding experiment for immediate recognition.

These results indicate that while a lapse of 60″ between exposure and selection tends to reduce the results, nevertheless this tendency is not sufficiently general nor sufficiently marked for experimental purposes.

3. Frequency

McG alone was tested for delayed recognition in a series of experiments in which the exposure of 5 cards after the manner of the previous experiments was repeated with an interval of about 2″ between repetitions.

Experiments with Pictures. 10 tests with 5 repetitions and with an interval of 30″ between the last exposure and selection gave 48 R. and 2 W. from 50 T. 10 similar tests in which the interval, however, was 60″ gave 48 R., 1 H. R., and 1 W. from 50 T. There is a total of 96 per cent R. as against 76 per cent R. in the corresponding experiments without repetition.

Experiments with Figures. Tests with 5 repetitions gave the same results as were obtained in experiments without repetition. The subject became drowsy during the experiments. With only 3 repetitions and with an interval of 60″ between the last ex-

posure and selection the average results for the different kinds of figures show an increase of 15 per cent R. over those in experiments without repetition.

4. Retroactive Inhibition

A few experiments performed with *McG* in which a second set of cards was presented in the interval between exposure and selection of the primary set failed to show a derogatory influence of retroactive inhibition.

II. METHOD

1. Material

The material used in the present investigation has already been briefly described in the account of preliminary experiments. It consisted of two main groups, pictures of objects and irregular figures.

The pictures were of two kinds, colored and half-tone pictures, arranged in separate series and mounted on white cards 3½″ x 4″. They were gathered from illustrated magazines and commercial catalogues and represent familiar objects such as men, women, and children in different situations, domestic and wild animals, articles of clothing, furniture and household articles, farm implements, fruits, flowers, and vegetables, houses, boats, vehicles, etc.

There were four kinds of irregular figures, black and colored figures cut from paper, straight lines drawn in black on white paper, and black ink blots on white paper. These were arranged in different series. In designing the material care was taken to avoid resemblance to objects so that the naming of the figures by the subject would be excluded. The figures were mounted like the pictures. Plate I shows some specimen of black figures, colored figures, and straight lines, grouped in pairs.

The whole material comprised one series of three hundred colored pictures, one of eight hundred half-tone pictures, and one series of one hundred of each of the four kinds of irregular figures.

In each picture series the cards were arranged in pairs so that the two pictures in a pair had a certain resemblance without being alike. Thus an Airdale and a Boston terrier, a fat butler and a fat clergyman, a boy and a girl at play, a knife and a fork, a razor and a safety razor, etc., formed pairs in the picture series. The figures were similarly arranged so that the general form and outline was common to the members of a pair and the details formed the differentiating element.

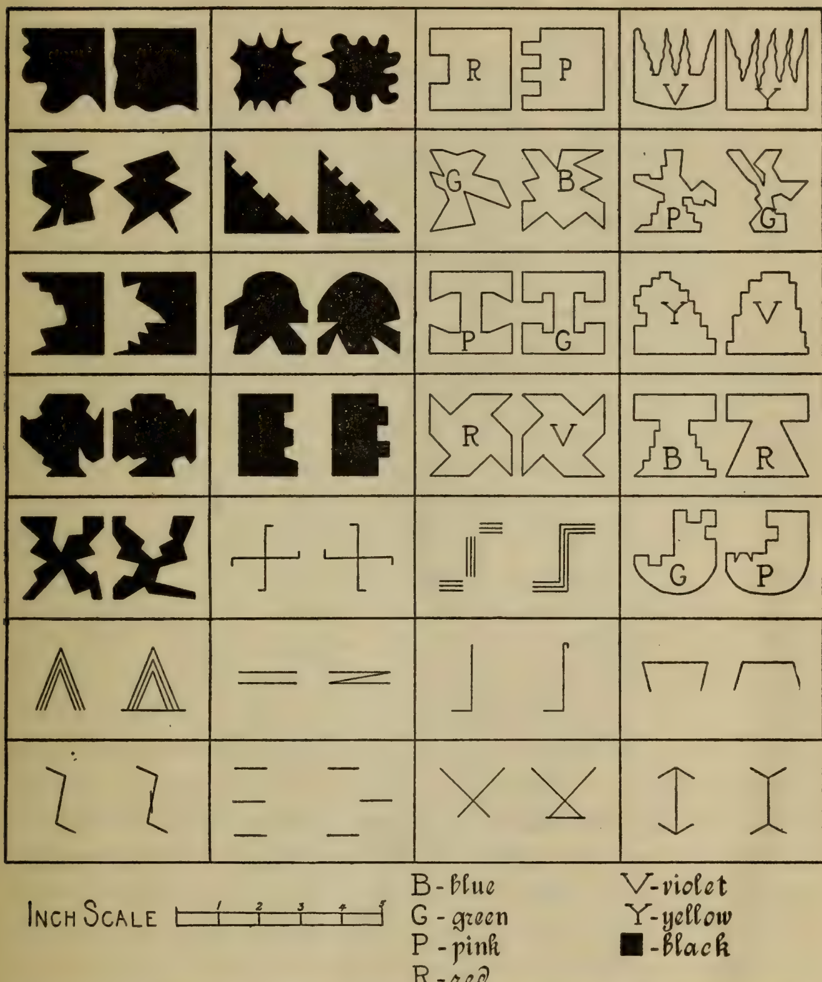


PLATE I.—Specimen of black figures, colored figures, and straight lines, forming part of the material used in experiments with "figures." Each section of the plate contains a pair of "figures."

The cards were numbered on the reverse side, each series separately, so that an odd and the subsequent even number marked the two members of a pair. The irregular figure series were then mixed in such a manner that a new series was formed in which five pair of black figures were followed by five pair of colored, these by five pair of straight lines, these by five pair of

ink blots, and so on. Thus mixed, the cards were provided with a second serial number.

There were now three main series of cards, the half-tone pictures numbered from 1 to 800, the mixed irregular figures numbered from 1001 to 1400, and the colored pictures numbered from 2001 to 2300. Each of these series was divided in two piles, one containing the odd, the other the even numbered cards.

The material was designed primarily for visual stimulation. In experiments made for the purpose of comparison between different materials Kirkpatrick[1] and Calkins[2] established the superiority of visual over auditory stimuli, and of pictured objects over words in tests of recall memory. In our material the pictures would therefore be expected to offer great facility for recollection. When the subject names them at presentation they occasion, besides the visual, also auditory and kinaesthetic stimulation. They are rich in associations and may be remembered mediately in terms of language.

The irregular figures, on the other hand, offer material which at least largely eliminates other than visual memory. The character of this material excludes its use in recall tests. In tests of five cards the series presented is uniform, that is, it is limited to one of the four sub-groups, and the subject has to select from among ten cards. Hence, the memory tested is that of the details which differentiate five individual figures of one of the four kinds from five other figures of the same kind. This differentiation is of visual quality and cannot easily be expressed in terms of language. The test is therefore, at least in a high degree, one of visual and immediate memory.

2. Apparatus

In the main experiments the following apparatus was used:

a. An ordinary fall apparatus for exposing the cards for desired intervals of time of the character of an Atwood machine. The slide was counterbalanced with lead weights and had an adjustable opening. By adjusting this opening and interchang-

[1] *Psychol. Rev.*, Vol. I, p. 602.
[2] *Psychol. Rev.*, Vol. V, pp. 451-62.

ing three counterbalancing weights the time of exposure of a card could be set for from 1″ to 1/50″. Tuning fork records of the times of fall showed a maximum inaccuracy of 5 per cent.

b. A large pasteboard tray divided by pasteboard strips into thirty equal squares large enough to hold one card each. The squares were numbered from one to thirty, the numbers being irregularly distributed. There was an additional tray for twenty cards to be used in experiments requiring presentation of more than thirty cards.

c. A black satin curtain suspended from the horizontal arm of a rod the vertical arm of which was fastened to the laboratory table. The arms of the rod were about four feet long. The curtain when drawn out would hide from the subject the tray, the piles of cards, and the hand of the experimenter manipulating the cards; when drawn aside it would expose the cards on the tray to the subject's view.

d. An ordinary watch was used for recording time other than time of exposure.

3. Procedure

A. General

The general procedure of the experiment was as follows. The subject was seated facing the laboratory table with the fall apparatus exposed and the curtain hiding the tray. The experimenter stood on the left side of and behind the fall apparatus, the cards to be used were placed out of sight of the subject. Immediately before each experiment its nature was carefully explained to the subject.

The "method of selection" was used in recognition tests. It has been stated that the cards were arranged in pairs and numbered with an odd and the subsequent even number in each pair. If five odd numbered cards were to be used in a test the corresponding even numbered cards would first be placed in their proper position on the tray. The spatial relations of the exposed and non-exposed cards were changed from test to test. The apparatus having been adjusted for the desired time of ex-

posure the experimenter would then expose one by one the odd numbered cards in the apparatus and after each exposure put them in place on the tray. The exposure of the series completed, there were ten cards on the tray, five of which had been seen, and the other five not seen by the subject. The curtain was then drawn aside either immediately or after a desired interval of time, and the subject was told to pick out the cards he had seen.

In recall tests the same procedure was followed, but before the curtain was drawn aside for selection the subject was told to report orally the cards he had seen. The recall tests were thus combined with recognition tests.

B. The Experiments

Two general methods of testing were used as indicated above, that of recognition by selection and that of reproduction by recall. The recognition method was used with all the material, in addition to which the recall method was used with the colored and the half-tone pictures only.

There were five variable factors in the experiments.

a. *Material.* The role of this factor was to differentiate visual-auditory-kinaesthetic-mediate from visual-immediate memory. Experiments with half-tone pictures in which time of exposure, number of cards to the test, and interval between exposure and selection were variable were repeated with figures in order to show any difference in memory for different materials under various conditions. The colored pictures were used in two similar experiments, one of which served partly as an introductory experiment for the purpose of absorbing the primary, passing inefficiency of the subjects. The other experiment was placed number six in the series for the purpose of establishing, by way of comparison with the first, a possible change in the subject's efficiency during prolonged experimentation.

b. *Interval between exposure and selection.* This factor was introduced to give separate expression of apprehension and of retention. The first six experiments were divided into sets containing three to six tests each. Some of these sets were for im-

mediate recall followed by delayed recognition. In four experiments the remaining sets were arranged in pairs of tests for immediate recognition and of tests for recognition after an interval of three minutes counted from the completed exposure of the last card. In tests with normal subjects the interval was increased to five minutes. In each of these experiments there is one and the same variable factor within all the sets of tests, viz. time of exposure in Exp. II and III, and number of cards in Exp. IV and V, and another variable factor between the sets, viz. time elapsing between exposure and selection.

c. *Number of Cards.* The preliminary experiments indicated that some subjects could remember about five and others about ten cards with a reasonable proportion of error. We have therefore accepted five and ten cards as the "normal" sets of cards for the two groups of subjects respectively. The "normal" set was used in all experiments with pictures and with figures in which the number of cards to the test was constant. In other experiments in which the time was constant the number of cards forms the variable factor. There were four variations, the sets comprising 5, 10, 15, and 20 cards respectively for the group using the "normal" 10-card set and 3, 5, 7, and 9 cards respectively for the group using the "normal" 5-card set. In experiments with normal subjects the "normal" set comprised 15 cards, and the variables were 5, 10, 15, 20, and 25.

d. *Time of Exposure.* The preliminary experiments showed one second to be amply sufficient time of exposure. As a fact, it was later found that with some subjects almost identical results were obtained with exposure of 1/5″. Exposure for one second was used in the experiments with colored pictures. In the experiments with half-tone pictures and with figures in which time of exposure formed the constant factor it was reduced to 1/5″. In the experiments with half-tone pictures and with figures in which time of exposure was a variable factor five variations were made, viz. 1″, 1/5″, 1/10″, 1/25″, and 1/50″. These variations were designed to modify the intensity of stimulation.

e. *Frequency.* Only a few experiments were performed with

half-tone pictures for recall memory in which each series of cards was exposed four times.

C. Experimental Procedure

To provide for variation in the different factors the experiments were arranged in eight groups to be known hereafter as Experiments I to VIII. They succeeded one another in numerical order.

Experiments I and VI were alike in character. One experiment day was given to each. The material was colored pictures; time of exposure was 1″. The "normal" set of 5 cards was used for two subjects, McG and E-n, that of 10 cards for two other subjects, H-n and D-n. With each subject of the first group each experiment comprised 5 tests for immediate recognition, and 5 for recall and delayed recognition combined. With each subject of the second group Exp. I comprised 2 tests for immediate recognition and an equal number for recall and delayed recognition combined, and Exp. VI. 5 tests each for immediate recognition and for recall and delayed recognition combined. This gave a total of 34 tests for immediate recognition and an equal number for recall and delayed recognition, or a grand total of 68 tests.

Experiment II was performed with half-tone pictures. The "normal" set of 5 cards was used with two subjects, McG and E-n, and that of 10 cards with two other subjects, H-n and D-n. Variable factor: time of exposure. With McG the experiment covered eight, with each of the remaining subjects five experiment days. The experiment comprised 40 tests per subject in the first group, distributed with 15 tests each for immediate and delayed recognition and 10 tests for recall and delayed recognition combined. McG had 1 additional test each for immediate recognition and for recall and delayed recognition combined. In the second group H-n had 12 tests for immediate, and an equal number for delayed recognition, and 5 for recall and delayed recognition combined. D-n had 8 tests for immediate and 9 for delayed recognition, and 4 for recall and delayed recognition combined. This made a total of 51 tests for immediate and for

delayed recognition each, and 30 for recall and delayed recognition combined, or a grand total of 132 tests. The distribution of these tests over the varying factor may be seen in Tables V, VII, IX, and XI in which, however, among the tests for exposure of 1/5″ are counted also those for the "normal" set of Exp. IV. E-n could not be tested for exposures of shorter duration than 1/10″.

Experiment III was performed with figures. It was otherwise essentially a reproduction of Exp. II, with the exception that recall tests were lacking. With McG it was distributed over four, with the remaining subjects, over five experiment days. McG and E-n had each 20 tests for immediate and 20 for delayed recognition. H-n had 10 tests for immediate and 12 for delayed recognition. D-n had 10 tests each for immediate and for delayed recognition. The total was 60 tests for immediate and 62 for delayed recognition, or a grand total of 122 tests. The distribution of these tests over the varying factor may be seen in Tables VI, VIII, X, and XII, in which the tests for "normal" set of Exp. V are counted among those for exposure of 1/5″. E-n could not be tested for exposures of shorter duration than 1/25″.

Experiment IV was performed with half-tone pictures. The time of exposure was 1/5″. Variable factor: number of cards to the test. McG and E-n were tested with 3, 5, 7, and 9 cards; H-n and D-n with 5, 10, 15, and 20 cards. The experiment was divided over five experiment days with McG and D-n, and over four with E-n and H-n. With each subject of the first group (McG and E-n) it comprised 12 tests for immediate recognition, 12 for delayed recognition, and 9 for recall and delayed recognition combined. With H-n it included 5 tests for immediate and delayed recognition each, and 7 for recall and delayed recognition combined, and with D-n 7 tests for immediate and delayed recognition each, and 8 for recall and delayed recognition combined. This makes 36 tests for immediate and delayed recognition each and 33 tests for recall and delayed recognition combined, or a grand total of 105 tests. The distribution of these tests over the varying factor may be seen in Tables XIII, XV, XVII, and XIX.

Experiment V was performed with figures. It was otherwise essentially a repetition of Exp. IV with the exception of lacking recall tests. With D-n it was distributed over three, with McG, E-n, and H-n over four experiment days. McG and E-n each had 16 tests for immediate and an equal number for delayed recognition. H-n and D-n each had 10 tests for immediate and an equal number for delayed recognition. The total was 52 tests for immediate and delayed recognition each, or a grand total of 104 tests. The distribution of these tests over the varying factor may be seen in Tables XIV, XVI, XVIII, and XX.

Experiment VII was performed with half-tone pictures. The "normal" set of 10 cards was used with two subjects, H-n and D-n. It covered five experiment days with each subject. Each day 4 tests were made with each subject in the following manner. 7 cards of the set were exposed in succession for 1/5″ each, and after a lapse of 2′ the subject was told to recall the pictures seen. Three minutes were allowed for the recall, after which time the same 7 and one additional card were exposed and the procedure after exposure repeated. Thus for each test one card was added so that in the fourth test 10 cards were exposed. 20 tests were made with each subject, making a total of 40 tests.

Experiment VIII was arranged in the same manner with the exception that 30″ after each exposure of a set an equal set of colored pictures was exposed, each for 1/5″. Thus each series of half-tone pictures was followed by an equal series of colored pictures. 2′ after exposure of the half-tone picture series the subject was made to recall the pictures in that series. The experiment covered five experiment days with each subject. Each subject had 20 tests, making a total of 40 tests.

In all the experiments each subject was tested for a maximum of one hour on each experiment day. A card was used only once with each subject, but the two series of odd and even numbered cards were used alternately, always, however with an interval of at least two weeks.

4. Method of Scoring

Woodworth's method of scoring in recognition consists in subtracting from total presentations omissions and twice the errors. The last item eliminates the factor of guessing on the supposition that in a sufficiently large series the number of guesses is equally distributed over right and wrong selections. For every wrong selection there would therefore be a right guess, and the total number of guesses is twice the errors.

It is desirable also to provide for the factor of hesitation in selection for which reason we arbitrarily give selection after hesitation half the value of selection without hesitation. To compare the scores for groups using normal sets of different size and for tests in which the number of cards is varied we express the score in per cent value. We arrive at the following formula for recognition score, used in the present investigation.[3]

$$\frac{(T - N - 2W - HW - \frac{HR}{2}) \times 100}{T} = \text{Score per cent.}$$

In the recall score the factors of guessing and of hesitation obviously need not be considered, and the formula will be:

$$\frac{100\ R}{T} = \text{Score per cent.}$$

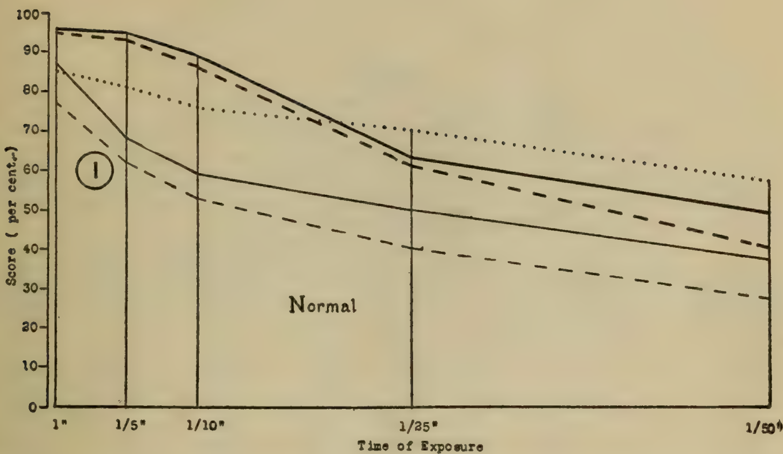
[3] For meaning of letters in formula see p. 4, n. 1.

III. EXPERIMENTS WITH NORMAL SUBJECTS

For the purpose of comparing the memory of defective with that of normal individuals a series of experiments were made with subjects of the latter group. Ten subjects were chosen and divided into two equal groups to be known as A and B respectively. Group A consisted of one executive secretary (F-n), one teacher (C-n) and one student (L-d) at a Social Service School, one executive Social Service Worker (C-l), all female, and one colored maid (G-n). Group B consisted of two teachers (E-g and C-h) and one student (M-n) of the aforesaid Social Service School, one Government clerk (M-r) all female, and one male college graduate (R-s). The age of these subjects varied from twenty to thirty-five years.

The method described in the foregoing section was applied with certain modifications. Only Exp. II to V were made. The "normal" set of cards was extended to 15 items, retention time in tests for delayed recognition was increased to 5 minutes, and in Exp. IV and V tests with 25 cards to the set were added. Experiments II and III were made only with the subjects of group A, Experiments IV and V only with those of group B. The experiments with pictures (II and IV) were distributed over three, those with figures (III and V) over two experiment days with each subject.

The number and distribution of tests in each experiment and the results are shown in Tables I-IV. The results are also represented in Figures 1 and 2.



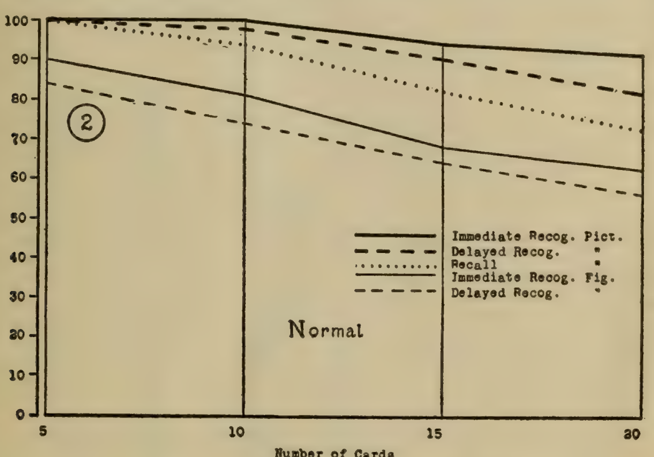


FIG. 1.—Variation in Time of Exposure. Per cent scores.
FIG. 2.—Variation in Number of Cards. Per cent scores. Both figures show the average results for normal subjects.

TABLE I

Experiments with Normal Subjects.

Selection from Half-tone Pictures. Variation in Time of Exposure.

15 cards shown in succession. Immediate recognition and recall. In delayed recognition retention time 5 minutes. 24 experiments with each subject equally distributed over tests for immediate recognition, recall and delayed recognition. Figures give per cent score.

	Time of Exposure				
a. *Immediate Recognition*	1″	1/5″	1/10″	1/25″	1/50″
Number of tests	1	2	2	1	2
Subjects					
F-n	100	100	97	67	67
L-d	93	93	93	60	53
C-n	100	100	97	53	33
C-l	87	87	60	47	60
G-n	100	97	100	87	33
Average	96	95	89	63	49
b. *Recall*					
Number of tests	1	2	2	1	2
Subjects					
F-n	93	87	87	80	73
L-d	87	80	67	60	53
C-n	80	73	67	67	40
C-l	80	80	73	67	53
G-n	87	87	87	77	67
Average	85	81	76	70	57
c. *Delayed Recognition*					
Number of tests	1	2	2	1	2
Subjects					
F-n	95	100	87	67	47
L-d	93	87	93	60	40
C-n	100	93	90	40	27
C-l	87	87	73	47	47
G-n	100	100	87	93	40
Average	95	93	86	61	40

TABLE II

Experiments with Normal Subjects.

Selection from Figures. Variation in Time of Exposure.

15 cards shown in succession. Immediate and delayed recognition. In delayed recognition retention time 5 minutes. 6 experiments for immediate and 7 for delayed recognition with each subject. Figures give per cent score.

	Time of Exposure				
a. *Immediate Recognition*	1″	1/5″	1/10″	1/25″	1/50″
Number of tests	1	2	1	1	1
Subjects					
F-n	87	73	67	53	33
L-d	80	60	47	27	33
C-n	93	73	60	60	40
C-l	73	47	33	33	20
G-n	100	87	87	77	60
Average	87	68	59	50	37
b. *Delayed Recognition*					
Number of tests	1	2	1	1	2
Subjects					
F-n	80	53	47	27	20
L-d	60	47	36	20	20
C-n	73	67	60	20	13
C-l	87	60	47	47	33
G-n	87	87	77	87	47
Average	77	62	53	40	27

TABLE III

Experiments from Half-tone Pictures. Variation in Number of Cards.

Cards shown in succession for 1/5″. Immediate recognition and recall; in delayed recognition retention time 5 minutes. 27 experiments with each subject equally distributed over tests for immediate recognition, recall, and delayed recognition. Figures give per cent score.

	Number of Cards				
a. *Immediate Recognition*	25	20	15	10	5
Number of tests	2	2	2	2	1
Subjects					
E-g	92	98	100	100	100
C-h	82	84	88	100	100
M-n	82	84	89	100	100
M-r	84	90	93	100	100
R-s	96	100	100	100	100
Average	87	91	94	100	100
b. *Recall*					
Number of tests	2	2	2	2	1
Subjects					
E-g	80	80	80	100	100
C-h	48	60	87	95	100
M-n	44	55	67	85	100
M-r	80	80	87	90	100
R-s	76	85	87	100	100
Average	66	72	82	94	100
c. *Delayed Recognition*					
Number of tests	2	2	2	2	1
Subjects					
E-g	76	80	100	90	100
C-h	48	72	72	100	100
M-n	62	72	89	100	100
M-r	72	80	90	100	100
R-s	96	100	100	100	100
Average	71	81	90	98	100

TABLE IV

Experiments with Normal Subjects

Selection from Figures. Variation in Number of Cards.

Cards shown for 1/5" in succession. Immediate and delayed recognition. In delayed recognition retention time 5 minutes. 14 experiments with each subject equally distributed over tests for immediate and for delayed recognition. Figures give per cent score.

	Number of Cards				
a. *Immediate Recognition*	25	20	15	10	5
Number of tests	1	1	2	2	1
Subjects					
E-g	76	80	87	100	100
C-h	52	60	60	65	80
M-n	36	50	60	80	90
M-r	36	40	47	60	80
R-s	80	80	87	100	100
Average	56	62	68	81	90
b. *Delayed Recognition*					
Number of tests	1	1	2	2	1
Subjects					
E-g	68	70	87	90	100
C-h	52	50	60	60	70
M-n	28	40	47	70	80
M-r	36	40	40	50	70
R-s	76	80	87	100	100
Average	52	56	64	74	84

IV. THE ABNORMAL SUBJECTS

Four subjects, patients at St. Elizabeth's Hospital in Washington, D. C., with memory defects associated with organic psychoses were selected for special investigation. Brief histories, so far as they are essential to the present study, follow; many details have been omitted.

McG. Male. Age 40 years. Born in U. S. Unmarried. Former sailor in U. S. Navy. Psychosis associated with cerebrospinal syphilis.

Family history negative. The subject went to school up to his fourteenth year when he became a mechanical laborer; later he enlisted in the U. S. Navy. He used alcohol as a rule moderately but occasionally to excess. In 1908 he contracted syphilis and received immediate treatment. A year later a stiffness appeared in his left arm and leg. He received hospital treatment and was able to return to duty and after expiration of his enlistment in 1912 to resume his occupation as a laborer. On admission to St. Elizabeth's Hospital in November 1914 the subject had no memory of the events leading to his being sent there and was unable generally to give information about himself. Neurological examination showed poor grip, weaker on the left than on the right side. There was apparent spastic paralysis of the muscles of the left side, the left foot being extended on the leg and almost immovable. The muscles of the face were greatly paralyzed. The left side showed a Babinski and ankle clonus. All deep reflexes were exaggerated; the gait was unsteady and stiffened with dragging of the left foot. A mental test in February 1915 gave the following results:—Special memory test deficient. Simple calculation good. Months and days were given correctly forward and backward, and figures of four digits were given correctly and transposed. General information good. Memory of current events deficient. Since this time the subject has undergone a gradual deterioration. The following diagnosis

was made. Cerebrospinal syphilis. Lacunar softenings with involvment on both sides. The lesions are probably:—Right side, extensive in the internal capsule; left side, of very slight extent in the capsule. There may also be cortical lesions; possibly also some in the posterior portion of the internal capsule or the thalamus, and in the spinal cord.

In the laboratory the subject showed lack of orientation, decreased power of conception and observation, and retrograde and anterograde amnesia. He was willing to assist at the experiments but was noisy and talkative and failed to pay voluntary attention to his tasks. He would constantly repeat the same stream of talk, ending with a song. He did not remember from day to day the answers to the same questions he asked almost daily for months. Incidents with strong emotional setting, however, were remembered but always referred to as of more recent occurrence. He had no memory of events following the infection and confabulated when asked about that period.

E-n. Male. Age 64 years. Born in Sweden. Married. Former sail-maker's mate in U. S. Navy. Senile or pre-senile psychosis.

Family history unknown. The subject went to school from his eighth to his nineteenth year. At twenty-two he went to sea. He states that he was a moderate user of alcohol and tobacco. He suffered with mental confusion in 1917 and was taken to a Naval hospital where he was found disoriented, confused, and lacking insight. There were traces of sugar in the urine. After diet and treatment the urine became sugar free, but the mental condition persisted. On admission to St. Elizabeth's Hospital in December 1917 his physical condition was fair, but he was nervous. He showed himself disoriented in all fields. His memory was poor for recent events, special memory was also very poor. The months and days were given correctly forward and backward. He could transpose three digits. He had no knowledge of current events, and his ability for calculation was poor. His talk was generally relevant and coherent, but sometimes he became confused and spoke in an irrelevant and incoherent man-

ner. He was quite disoriented and lacked insight and judgment. He gave his age usually as 104 or 163 years, once or twice he gave his real age. On a hot July day he would say that it was January and that there ought to be snow. Occasionally he would laugh to himself, on other occasions his face would contract as if he were going to cry.

In the laboratory he was very tractable and quiet. He was willing to coöperate but often became distracted and failed to attend to the tests voluntarily. He complained of poor eye-sight, received glasses but could not be made to use them. When the cards were presented for selection he would usually show surprise, deny having seen any, or say that he had seen all. When told that he had seen five of the ten cards he would look at the cards, slowly take one by one and, on being questioned, admit or deny that he had seen them. At other times he would make a rapid selection.

H-n. Male. Age 54 years. Born in U. S. Married. Retired Army Officer. Psychosis associated with cerebral arterio-sclerosis.

Family history negative. The subject had yellow fever in 1899 and later, while in the Philippines, malaria, dengue, and dysentery. He was a moderate user of alcohol. While serving in the Philippines in 1904 he developed severe intestinal trouble and was subsequently returned to the U. S. On the journey home he was very weak, was unable to stand, became cross-eyed, and had hallucinations and delusions. There is complete amnesia for the two years following this period. He was retired from service. From this time to 1917 his symptoms were confusion of ideas, poor memory and lack of interest in current events. During the war he served for a year as Quartermaster but was finally relieved from duty because of discrepancies in his accounts. At that time he showed amnesia particularly for recent events. He had had various neurasthenic complaints. On admission to St. Elizabeth's Hospital in October 1920 the subject was found physically well developed. Neurological examination showed:—Muscle power equal, fairly good and fairly well sustained. Reflexes:

upper extremities equal and normal, corneal and pharyngeal present, abdominal not obtained, patellar decreased, no ankle jerks. Slight swaying in Romberg, no Babinski, lack of coördination of fingers to nose, slight tremors of outstretched fingers. The subject was oriented and no hallucinations or delusions were elicited. He had a fair knowledge of current events. There was a gross memory defect with poor memory for details. Dates of historical events were given correctly but details were lacking. Names of childhood associates and details of events in his own life were poorly recalled. His conversation was slow though relevant and coherent. He was diagnosed first as undifferentiated psychosis with depression, and in December 1920 this was corrected to psychosis associated with cerebral arterio-sclerosis. In the spring of 1921 he was improved. Outside his memory defect there were practically no mental symptoms at the time. A hospital note of September 1921 records a further improvement, particularly in his memory for past events.

In the laboratory his manner and conversation were in every respect normal. He coöperated excellently in the experiments and showed a great desire to get well. He was most enthusastic over the tests which he thought to be therapeutic.

D-n. Female. Age 53 years. Born in U. S. Widow. Toxic psychosis, Korsakow type.

The subject has a sister who is an imbecile. A brother used alcohol to excess and committed suicide. The father also used alcohol to excess, the mother moderately. She comes of a socially prominent family and has enjoyed a refined education. In her youth she had a successful career on the dramatic stage. She had literary talent. At the time of the death of her husband in 1906 she was depressed and indifferent to her surroundings, she had previously been using alcohol to excess and probably also morphine and cocaine. On admission to St. Elizabeth's Hospital in August 1907 she had multiple neuritis, optic atrophy, weak heart, and a tendency to constipation. Neurological examination showed:—Tingling sensation in the fingers of both hands. Grip in both hands very weak. Plantar reflexes diminished, especially on left side, patellar and Achilles reflexes absent, no ankle clonus.

Sensation for light touch diminished, and to heat and cold normal in both arms and legs. Sensation over trunk, taste, smell and hearing normal. Pain on pressure over popliteal nerve on the left leg—none on the right. There were no areas of anaesthesia, no girdle pains, no gastric crises. She was unable to stand unaided, and, when assisted in standing, her feet and legs became cyanosed. The mental symptoms were:—Clouding of consciousness, fatigue on slight mental exertion, and slight apprehensiveness. She had some insight into her own condition. The intelligence test was good, the attention test fair. Delusions and hallucinations were recorded previous to her admittance to the hospital. Memory for recent events was poor and associative memory defective. There was marked falsification of memory, disorientation for time and place, and a tendency to confabulation and to indulgence in pseudo-reminiscences. In January 1909 she was greatly improved. Her physical health was good, she was oriented as to time, place and person, showed good judgment and reasoning, and appeared mentally normal but for slight memory defect. Her memory seemed normal for events up to the outbreak of the psychosis, following which there is a period of complete amnesia. A memory test in 1914 showed:—Associative memory good, general information good, memory for current events faulty. In June 1918 she was discharged as sufficiently improved to take up outside work, but returned in 1920 with a recurrance of her psychosis. At the time of the present investigation the subject enjoyed good physical health. She was engaged in simple clerical work for the hospital. She appeared mentally normal but for a slight impairment in judgment, a certain emotional instability, and a defect in memory for recent events. She coöperated well in the experiments and was anxious to make a recovery.

V. INDIVIDUAL RESULTS

1. Variation in Time of Exposure

Subject: McG

Experiments with Pictures. Experiment II gave the following results (Table V). In immediate recognition the score is 73 per cent for exposure of 1″ and declines rapidly for shorter exposures, being 54, 53, 20 and 6 per cent respectively for exposures of 1/5″, 1/10″, 1/25″, and 1/50″. There is no appreciable difference between the results for exposures of 1/5″ and 1/10″, but the difference between these figures and the 73 per cent obtained for exposure of 1″, together with the total difference of 67 per cent between the results for 1″ and 1/50″ exposures show that short exposures prevented clear apprehension. This is further borne out by the complaint of the subject that the experimenter was "going too fast," particularly with exposures of 1/25″ and 1/50″.

A similar rapid decline is found in the results for delayed recognition. The scores are 60, 33, 33, 20, and 7 per cent for exposures from 1″ to 1/50″ respectively. Comparing these results with those for immediate recognition we find that for exposures of 1″, 1/5″, and 1/10″ there is a considerable difference in score, which difference is wholly or practically absent in the results for exposures of 1/25″ and 1/50″. The differences for the three longer exposures, counting from that of 1″, are 13, 21, and 20 per cent respectively. These differences we would associate with the lapse of time between exposure and selection. It would then seem that the low results obtained with the two shortest exposures in delayed recognition are due not to the transformation of the mental impression in the interval of 3 minutes, but to poor apprehension.

The results for delayed recognition after recall are, as a whole, lower than those for delayed recognition without recall. The scores are 47, 44, 10, 20, and –20 per cent for the respective ex-

TABLE V

Summary of Experiments with Pictures and Variation in Time of Exposure.
Subject: McG.

1. *Immediate Recognition*

No. of Exp't	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests
II.	1″	12	–	–	3	–	15	73	3
II. and IV.	1/5″	27	–	–	8	–	35	54	7
II.	1/10″	23	–	–	7	–	30	53	6
II.	1/25″	6	–	–	4	–	10	20	2
II.	1/50″	8	–	–	7	–	15	6	3 21

2. *Recall and Delayed Recognition*

No. of Exp't	Time of Expos.	Recall R	Recall Hes. R	Recall Hes. W	Recall W	Recall N	Recall T	Score per cent	Delayed Recognition R	Delayed Recognition Hes. R	Delayed Recognition Hes. W	Delayed Recognition W	Delayed Recognition N	Delayed Recognition T	Score per cent	No. of Tests
II.	1″	6	–	–	–	9	15	40	11	–	–	4	–	15	47	3
II. & IV.	1/5″	10	–	–	–	15	25	40	18	–	–	7	–	25	44	5
II.	1/10″	5	–	–	–	15	20	25	11	–	–	9	–	20	10	4
II.	1/25″	–	–	–	–	5	5	0	3	–	–	2	–	5	20	1
II.	1/50″	1	–	–	–	9	10	10	4	–	–	6	–	10	–20	2 15

3. *Delayed Recognition*

No. of Exp't	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests
II.	1″	12	–	–	3	–	15	60	3
II. and IV.	1/5″	19	–	2	9	–	30	33	6
II.	1/10″	20	–	–	10	–	30	33	6
II.	1/25″	6	–	–	4	–	10	20	2
II.	1/50″	8	–	–	7	–	15	7	3 20
								Total tests	56

posures. The effort to recall would therefore seem to be an interference with the recognition memory. In this connection it should be noted that the subject hardly ever could be made to remain quiet in the retention interval in experiments for delayed recognition without recall. He would attempt to talk about himself, to ask questions about the experimenter and the hospital physicians, or to sing: hence it is fair to assume that his mind would be occupied but not with the experiment. It is therefore not the mental occupation, but the particular effort to recall that differentiates the experiments for delayed recognition with and without recall. The difference in results must then be ascribed to the latter factor.

The results for recall are, on the whole, lower than those for recognition. For the respective exposures the scores are 40, 40, 25, 0, and 10 per cent. The recall memory is, therefore, less good

than the recognition memory. There are two considerable drops in the scores, one occurring with 1/10″ and the other with 1/25″ exposure. These drops must be ascribed to reduced apprehension as a result of decreased stimulation time.

Experiments with Figures. Experiment III gave the following results (Table VI). In immediate recognition the scores are 50, 27, 15, 10, and 8 per cent for the respective exposures from 1″ to 1/50″. In general these scores are lower than the corresponding scores for pictures, the differences for the various exposures being respectively 23, 27, 38, 10, and –2 per cent. With decreasing stimulation time these scores drop more rapidly than those for pictures up to and including exposure for 1/10″, from then on the two series of scores converge, becoming practically identical for 1/50″ exposure.

TABLE VI

Summary of Experiments with Figures and Variation in Time of Exposure
Subject: McG.

No. of Exp't.	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
		1. Immediate Recognition								
III.	1″	15	–	–	5	–	20	50	4	
V.	1/5″	19	–	–	11	–	30	27	6	
III.	1/10″	23	–	–	17	–	40	15	8	
III.	1/25″	11	–	–	9	–	20	10	4	
III.	1/50″	10	1	–	9	–	20	8	4	26
		2. Delayed Recognition								
III.	1″	14	–	–	6	–	20	40	4	
V.	1/5″	17	–	–	13	–	30	13	6	
III.	1/10″	22	–	–	18	–	40	10	8	
III.	1/25″	11	–	–	9	–	20	10	4	
III.	1/50″	8	–	–	12	–	20	–20	4	26
									Total tests	52

With this material, therefore, apprehension also deteriorates rapidly with the decrease in stimulation time. In general, pictures offer greater facility for apprehension, but this advantage disappears when the stimulation time becomes sufficiently decreased.

In delayed recognition the scores for the respective exposures are 40, 13, 10, 10, and –20 per cent. The corresponding differences between these scores and those for immediate recognition

are 10, 14, 5, 0, and 28 per cent. Comparing these with the corresponding figures for pictures we find the present differences somewhat smaller and disappearing sooner than was the case with pictures. The retention time factor shows a considerable influence in reducing the scores for 1″ and 1/10″ exposure; for shorter exposures this influence decreases and the low results must be ascribed to poor apprehension.

Throughout the series of experiments it was noticed that the quality of the picture or figure presented did, to a certain extent, influence apprehension and memory. Pictures with girls, sailors, and ships made a stronger impression on account of their emotional connotation, as did also green and blue figures—the subject was Irish and a former sailor. He became more interested when material of this character was presented. In tests for recall this factor was very apparent; in tests for recognition it was not noticed to have an effect, since the subject was no more correct in his choice between two items of the pleasing character.

Subject: E-n

Experiments with Pictures. The results obtained in Experiment II are shown in Table VII. In immediate recognition the

TABLE VII

Summary of Experiments with Pictures and Variation in Time of Exposure. Subject: E-n.

1. *Immediate Recognition*

No. of Exp't	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
II.	1″	33	–	–	17	–	50	32	10	
II. and IV.	1/5″	17	1	–	6	6	30	37	6	
II.	1/10″	9	–	–	2	9	20	35	4	20

2. *Recall and Delayed Recognition*

No. of Exp't	Time of Expos.	Recall R	Recall Hes. R	Recall Hes. W	Recall W	Recall N	Recall T	Score per cent	Delayed Recognition R	Delayed Recognition Hes. R	Delayed Recognition Hes. W	Delayed Recognition W	Delayed Recognition N	Delayed Recognition T	Score per cent	No. of Tests	
II.	1″	5	–	–	–	20	25	20	11	–	–	5	9	25	24	5	
II. & IV.	1/5″	4	–	–	–	21	25	16	10	–	–	8	7	25	8	5	
II.	1/10″	3	–	–	–	17	20	15	2	–	1	1	16	20	5	4	14

3. *Delayed Recognition*

No. of Exp't	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
II.	1″	27	2	–	14	2	45	31	9	
II. and IV.	1/5″	17	–	–	9	4	30	27	6	
II.	1/10″	6	–	–	2	17	25	16	5	20

Total tests 54

scores are 32, 37, and 35 per cent for exposures of 1″, 1/5″, and 1/10″ respectively. The subject was quite unable to make out the pictures when exposed for 1/25″—he would look up astonished and say that he could see nothing. For this reason the tests for 1/25″ and 1/50″ were not continued. The scores are low but show little variation. They are slightly better for exposure of 1/5″, and 1/10″ than for exposure of 1″; the best result is obtained with exposure of 1/5″.

In delayed recognition there is more variation in the scores which are 31, 27, and 16 per cent for exposures of 1″, 1/5″, and 1/10″ respectively. The scores decline at an increasing rate with the gradual shortening of the stimulation time. This difference between the two series of scores may find an explanation in the following facts. Table XXVII shows that in immediate recognition the last item exposed is most frequently selected, 80 per cent; the first and second, 63 per cent; the third, 60 per cent; and the fourth, 53 per cent. In delayed recognition the percentage selections from the five items are: fourth and fifth, 53 per cent; third, 50 per cent; and first and second, 43 per cent each. The greatest difference between the two scores, viz., 27 per cent, is found for the fifth item, the next greatest for each of the first two items, the difference for the third item is 10 per cent, and for the fourth there is no difference. The proportionately more frequent occurrence in immediate than in delayed recognition of the fifth item may be explained by the fact that in immediate recognition this item is selected immediately after having been exposed whereas new stimuli intervene between exposure and selection of the remaining items. If, therefore, we consider only the first four items, the percentages of selection are, counting from the first to the fourth item, in immediate recognition 63, 63, 60, and 53 per cent, and in delayed recognition 43, 43, 50, and 53 per cent. These figures present themselves in a descending scale for immediate and in an ascending scale for delayed recognition. This would suggest at least a more marked influence of retroactive inhibition in delayed than in immediate recognition, which factor in conjunction with the influence of re-

duction in stimulation time may explain the peculiar difference in the two scores.

The results for delayed recognition after recall are lower than those for delayed recognition without recall, the scores being 24, 8, and 5 per cent for exposures of 1″, 1/5″, and 1/10″ respectively. The subject usually remained quiet in the interval between exposure and selection in experiments for delayed recognition without recall. We may ascribe the lower results and the more rapid decline in the score to a deleterious influence of the effort to recall upon recognition memory.

The recall score is lower than that for immediate as well as that for delayed recognition; it decreases with the shortening of the stimulation time. The figures are 20, 16, and 15 per cent for exposures of 1″, 1/5″ and 1/10″ respectively.

Experiments with Figures. Table VIII gives the results of

TABLE VIII

Summary of Experiments with Figures and Variation in Time of Exposure. Subject: E-n.

1. *Immediate Recognition*

No. of Exp't.	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
III.	1″	22	1	–	7	–	30	52	6	
V.	1/5″	23	–	–	7	–	30	53	6	
III.	1/10″	27	–	–	13	–	40	35	8	
III.	1/25″	15	–	–	8	7	30	23	6	26

2. *Delayed Recognition*

No. of Exp't.	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
III.	1″	19	–	–	10	1	30	30	6	
V.	1/5″	19	1	–	10	–	30	32	6	
III.	1/10″	21	–	4	15	–	40	15	8	
III.	1/25″	15	–	–	13	2	30	7	6	26
									Total tests	52

Experiment III. In immediate recognition the scores are 52, 53, 35, and 23 per cent for exposures from 1″ to 1/25″ respectively. It is to be noticed that the subject was able to discern the figures when the time of exposure was reduced to 1/25″. With exposure of 1/50″, however, he could not make out the figures, for which reason tests with this exposure were discontinued. In general these scores are higher than those for pictures; with exposure of 1/10″ the results are the same for pictures and figures. As in

the scores for pictures the results with exposure of 1/5″ are better than those with 1″ exposure. The difference, however, for figures is less marked. The scores for figures decline rapidly after the 1/5″ mark has been reached.

It would then seem that figures offer greater facility for apprehension than pictures but that this advantage disappears with the shortening of the stimulation time to 1/10″.

The scores for delayed recognition are on the whole considerably lower than those for immediate recognition. They are 30, 32, 15, and 7 per cent for the respective exposures. The differences between the two series of scores for the respective exposures are 22, 21, 20, and 16 per cent; there is, therefore, a somewhat sharper decline in the score for immediate than in that for delayed recognition. With pictures the opposite tendency appeared. The difference between the scores was negligible for 1″ exposure but increased rapidly for exposures of 1/5″ and 1/10″. It is probable that retroactive inhibition is more pronounced in delayed than in immediate recognition, and we would therefore conclude that with figures this condition is not in evidence.

Subject: H-n

Experiments with Pictures. The following results were obtained in Experiment II (Table IX). In immediate recognition the scores are 95, 100, 93, 90, and 87 per cent for exposures of 1″, 1/5″, 1/10″, 1/25″, and 1/50″ respectively. The results for 1/5″ exposure are better than those for 1″ exposure, below there is a gradual decline along the series. The difference between the highest and lowest figures in the score is small, viz: 13 per cent, hence a gradual shortening of the stimulation time from 1/5″ to 1/50″ has a moderate, derogatory effect on apprehension.

The score for delayed recognition is identical with that for immediate recognition with the exception that with exposure of 1/50″ the score is 7 per cent lower. An interval of 3′ between exposure and selection has, therefore, practically no influence upon the results.

TABLE IX

Summary of Experiments with Pictures and Variation in Time of Exposure. Subject: H-n.

1. *Immediate Recognition*

No. of Exp't	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
II.	1″	39	–	–	1	–	40	95	4	
IV.	1/5″	20	–	–	–	–	20	100	2	
II.	1/10″	29	–	–	1	–	30	93	3	
II.	1/25″	19	–	–	1	–	20	90	2	
II.	1/50″	28	–	–	2	–	30	87	3	14

2. *Recall and Delayed Recognition*

No. of Exp't	Time of Expos.	Recall R	Hes. R	Hes. W	W	N	T	Score per cent	Delayed Recognition R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
II.	1″	6	–	–	–	4	10	60	9	–	–	1	–	10	80	1	
IV.	1/5″	12	–	–	–	8	20	60	18	–	–	2	–	20	80	2	
II.	1/10″	12	–	–	–	8	20	60	19	–	–	1	–	20	90	2	
II.	1/25″	6	–	–	–	4	10	60	9	–	–	1	–	10	80	1	
II.	1/50″	5	–	–	–	5	10	50	9	–	–	1	–	10	80	1	7

3. *Delayed Recognition*

No. of Exp't	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
II.	1″	38	–	2	–	–	40	95	4	
IV.	1/5″	20	–	–	–	–	20	100	2	
II.	1/10″	29	–	–	1	–	30	93	3	
II.	1/25″	19	–	–	1	–	20	90	2	
II.	1/50″	27	–	–	3	–	30	80	3	14
									Total tests	35

The score for delayed recognition after recall is 80 per cent for each item with the exception of exposure for 1/10″ in which case the score is 90 per cent.

The results for recall are considerably lower than those for recognition. The scores are 60 per cent for exposures from 1″ to 1/25″, and 50 per cent for 1/50″ exposure. It seems, then, that in this subject a variation in stimulation time has little effect on recall and on delayed recognition after recall.

Experiments with Figures. Experiment III gave the results in Table X. In immediate recognition the scores are 95, 85, 83, 80, and 80 per cent for the respective exposures from 1″ to 1/50″. These scores are somewhat lower than the corresponding scores for pictures, the differences for the various exposures being 0, 15, 10, 10, and 7 per cent. With decreased stimulation time the score drops somewhat less rapidly than that for pictures. An-

Table X

Summary of Experiments with Figures and Variation in Time of Exposure
Subject: H-n.

No. of Exp't.	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
		1. Immediate Recognition								
III.	1″	19	–	1	–	–	20	95	2	
V.	1/5″	26	1	2	1	–	30	85	3	
III.	1/10″	36	–	1	3	–	40	83	4	
III.	1/25″	18	–	–	2	–	20	80	2	
III.	1/50″	18	–	–	2	–	20	80	2	13
		2. Delayed Recognition								
III.	1″	18	–	–	2	–	20	80	2	
V.	1/5″	26	–	1	3	–	30	77	3	
III.	1/10″	35	–	–	5	–	40	75	4	
III.	1/25″	35	–	–	5	–	40	75	4	
III.	1/50″	17	–	–	3	–	20	70	2	15
									Total tests	28

other difference will be found in the fact that with figures the best results are obtained with a stimulation time of 1″ as against that of 1/5″ with pictures.

In delayed recognition the scores for the respective exposures are 80, 77, 75, 75, and 70 per cent. The corresponding differences between these scores and those in immediate recognition are 15, 8, 8, 5, and 10 per cent. With this material we find, therefore, a marked influence of the retention time factor on recognition. The influence of a gradual shortening of the stimulation time is less marked than was the case in immediate recognition.

Differences in results arising from emotional or interest effect of the material were not noticed in the experiments with this subject.

Subject: D-n

Experiments with Pictures. The results of Experiment II are found in Table XI. In immediate recognition the scores are 68, 63, 57, 30, and 15 per cent respectively for exposures from 1″ to 1/50″. There is an increasing decline in the scores with a gradual reduction in stimulation time, the difference between the scores for 1″ and 1/50″ exposure being 53 per cent.

A similar decline is found in delayed recognition, the scores

TABLE XI

Summary of Experiments with Pictures and Variation in Time of Exposure.
Subject: D-n.

1. *Immediate Recognition*

No. of Exp't	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
II.	1″	15	1	–	2	2	20	68	2	
IV.	1/5″	24	–	1	5	–	30	63	3	
II.	1/10″	22	–	1	5	2	30	57	3	
II.	1/25″	5	–	–	2	3	10	30	1	
II.	1/50″	10	–	–	7	3	20	15	2	11

2. *Recall and Delayed Recognition*

No. of Exp't	Time of Expos.	Recall R	Recall Hes. R	Recall Hes. W	Recall W	Recall N	Recall T	Recall Score per cent	Delayed Recognition R	Delayed Recognition Hes. R	Delayed Recognition Hes. W	Delayed Recognition W	Delayed Recognition N	Delayed Recognition T	Score per cent	No. of Tests	
II.	1″	5	–	–	–	5	10	50	8	–	–	2	–	10	60	1	
IV.	1/5″	19	–	–	–	11	30	63	25	–	–	5	–	30	67	3	
II.	1/10″	6	–	–	–	4	10	60	6	–	–	2	2	10	40	1	
II.	1/25″	5	–	–	–	5	10	50	6	–	–	4	–	10	20	1	
II.	1/50″	4	–	–	–	6	10	40	4	–	–	6	–	10	–20	1	7

3. *Delayed Recognition*

No. of Exp't	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
II.	1″	16	–	–	4	–	20	60	2	
IV.	1/5″	23	–	1	6	–	30	57	3	
II.	1/10″	27	–	–	6	7	40	53	4	
II.	1/25″	6	–	–	4	–	10	20	1	
II.	1/50″	7	–	–	6	7	20	5	2	12
									Total tests	30

being 60, 57, 53, 20, and 5 per cent. The difference between the scores for 1″ and for 1/50″ exposure is 55 per cent, hence practically the same as that in immediate recognition. The differences in score between immediate and delayed recognition for the various exposures from 1″ to 1/50″ are 8, 6, 4, 10, and 10 per cent respectively. An interval of 3′ between exposure and selection, therefore, moderately lowers the results in recognition.

The average result for delayed recognition after recall, if we except the score for 1/50″ exposure, is practically the same as that for delayed recognition without recall. The difference appearing with exposure of 1/50″ is not of sufficient value for drawing conclusions. It would therefore seem that the effort to recall has no noticeable effect upon delayed recognition.

The average recall score is higher than that for immediate recognition. The recall scores are 50, 63, 60, 50, and 40 per cent

for the respective exposures. The highest score is obtained with exposure for 1/5″, below there is a gradual decline, less marked than in recognition. The recall memory seems, therefore, to be superior to the recognition memory with this subject.

TABLE XII

Summary of Experiments with Figures and Variation in Time of Exposure. Subject: D-n.

1. *Immediate Recognition*

No. of Exp't.	Time of Exposure	R	Hes.		W	N	T	Score per cent	No. of Tests	
			R	W						
III.	1″	14	–	–	3	3	20	55	2	
V.	1/5″	20	–	1	9	–	30	37	3	
III.	1/10″	26	–	–	10	4	40	40	4	
III.	1/25″	8	–	–	6	6	20	10	2	
III.	1/25″	9	–	–	8	3	20	5	2	13

2. *Delayed Recognition*

No. of Exp't.	Time of Exposure	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
III.	1″	11	1	–	4	4	20	38	2	
V.	1/5″	18	–	–	12	–	30	20	3	
III.	1/10″	21	1	–	13	5	40	21	4	
III.	1/25″	10	–	–	10	–	20	0	2	
III.	1/50″	6	–	–	12	2	20	–30	2	13

Total tests 26

Experiments with Figures. The following results were obtained in Experiment III (Table XII). In immediate recognition the scores are 55, 37, 40, 10, and 5 per cent for the respective exposures. These scores are lower than the corresponding scores for pictures, the difference for the various exposures being 13, 26, 17, 20, and 10 per cent respectively. On the whole the scores decline with reduced stimulation time at a rate similar with that for pictures.

In delayed recognition the scores for the respective exposures are 38, 20, 21, 0, and –30 per cent. The differences between immediate and delayed recognition for the various exposures from 1″ to 1/50″ are 17, 17, 19, 10, and 35 per cent. These differences are considerably larger than the corresponding differences for pictures, hence an interval of 3′ between exposure and selection reduces the results in recognition more with figures than with pictures.

A slight influence of emotional connotation in the material was noticed in experiments with pictures, those of children making a particular appeal to the subject.

2. Variation in Number of Cards

Subject: McG

Experiments with Pictures. The results in Experiment IV are shown in Table XIII. In immediate recognition the scores are

Table XIII

Summary of Experiments with Pictures and Variation in Number of Cards. Subject: McG.

1. *Immediate Recognition*

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests
IV.	3	5	–	–	1	–	6	67	2
IV.	5	21	–	–	4	–	25	68	5
IV.	7	16	–	–	5	–	21	52	3
IV.	9	13	–	–	5	–	18	44	2 12

2. *Recall and Delayed Recognition*

No. of Exp't	No. of Cards	Recall R	Recall Hes. R	Recall Hes. W	Recall W	Recall N	Recall T	Recall Score per cent	Delayed Recognition R	Delayed Recognition Hes. R	Delayed Recognition Hes. W	Delayed Recognition W	Delayed Recognition N	Delayed Recognition T	Score per cent	No. of Tests
IV.	3	3	–	–	–	–	3	100	2	–	–	1	–	3	33	1
IV.	5	8	–	–	–	12	20	40	16	–	–	4	–	20	60	4
IV.	7	5	–	–	–	9	14	36	9	–	–	5	–	14	29	2
IV.	9	4	–	–	3	11	18	22	10	–	–	8	–	18	22	2 9

3. *Delayed Recognition*

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests
IV.	3	4	–	2	–	–	6	33	2
IV.	5	16	–	2	7	–	25	36	5
IV.	7	13	–	–	8	–	21	24	3
IV.	9	9	1	–	8	–	18	8	2 12
								Total tests	33

67, 68, 52, and 44 per cent for exposures of 3, 5, 7, and 9 cards respectively. Slightly better results are obtained with 5 than with 3 cards. With more than 5 cards the results show a gradual decline.

In delayed recognition the results are considerably lower, the corresponding scores being 33, 36, 24, and 8 per cent. We find the following differences between the two series of scores: 34, 32, 28, and 36 per cent. The greatest difference appears for the 9-card set and the smallest for the 7-card set, with a gradual increase towards the smaller sets.

In delayed recognition after recall the results are better than

in delayed recognition without recall, the scores being 33, 60, 29, and 22 per cent for the respective sets of cards. This was not generally the case in Exp. II, and the difference may be due to the fact that Exp. IV occurs in the middle of the series and is therefore preceded by a period of training. The figures in Table V for exposure of 1/5″, which are the only ones to show this tendency in that table, are largely taken from Exp. IV.

The recall scores are 100, 40, 36, and 22 per cent for the respective sets of cards. Hence the recall memory is perfect for 3 cards and superior to the recognition memory for the same number of items, but with an increased number of cards it is inferior to the recognition memory.

Experiments with Figures. Table XIV shows the results in

TABLE XIV

Summary of Experiments with Figures, and Variation in Number of Cards.

Subject: McG.

1. *Immediate Recognition*

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
V.	3	4	–	–	2	–	6	33	2	
V.	5	19	–	–	11	–	30	27	6	
V.	7	15	–	–	13	–	28	7	4	
V.	9	18	–	–	18	–	36	0	4	16

2. *Delayed Recognition*

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
V.	3	4	–	–	2	–	6	33	2	
V.	5	17	–	–	13	–	30	13	6	
V.	7	13	–	–	15	–	28	–7	4	
V.	9	18	–	–	18	–	36	0	4	16
								Total	tests	32

experiments with figures. The immediate recognition scores are 33, 27, 7, and 0 per cent for sets of 3, 5, 7, and 9 cards respectively. These scores are lower and decline more rapidly than those for pictures, the differences for the four sets being 34, 41, 45, and 44 per cent respectively. The slight advantage of the 5-card set over that of 3 cards with pictures does not obtain with figures.

In delayed recognition the scores are 33, 13, –7, and 0 per cent for the respective sets of cards. The corresponding differences from the immediate recognition scores are 0, 14, 14, and 0 per

cent; they are considerably smaller and less evenly distributed than those for pictures.

We may conclude that the subject is able to take in a set of 3 pictures sufficiently well for immediate recall, but is unable to take in enough characteristics of the same number of items of either material to distinguish them well from similar pictures or figures. With an increase in the number of items to the set, however, the results for recall become inferior to those for recognition.

Table XV

Summary of Experiments with Pictures and Variation in Number of Cards. Subject: E-n.

1. *Immediate Recognition*

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
IV.	3	4	–	–	2	–	6	33	2	
IV.	5	17	1	–	6	1	25	46	5	
IV.	7	14	–	–	7	–	21	33	3	
IV.	9	12	–	–	6	–	18	33	2	12

2. *Recall and Delayed Recognition*

Exp't No. of	Cards No. of	Recall R	Recall Hes. R	Recall Hes. W	Recall W	Recall N	Recall T	Score per cent	Delayed Recognition R	Delayed Recognition Hes. R	Delayed Recognition Hes. W	Delayed Recognition W	Delayed Recognition N	Delayed Recognition T	Score per cent	No. of Tests	
IV.	3	1	–	–	–	2	3	33	3	–	–	–	–	3	100	1	
IV.	5	4	–	–	–	16	20	20	9	–	–	8	3	20	5	4	
IV.	7	3	–	–	–	11	14	21	7	–	1	5	1	14	14	2	
IV.	9	2	–	–	–	16	18	11	11	1	–	6	–	18	31	2	9

3. *Delayed Recognition*

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
IV.	3	3	–	–	3	–	6	0	2	
IV.	5	16	–	–	9	–	25	28	5	
IV.	7	11	–	–	10	–	21	5	3	
IV.	9	9	–	–	9	–	18	0	2	12

Total tests 33

Subject: E-n

Experiments with Pictures. Table XV shows the results in Experiment IV. The scores for immediate recognition are 33, 46, 33, and 33 per cent for the corresponding sets of 3, 5, 7, and 9 cards. The score for 5 cards is superior to that for 3 items, and with 7 and 9 cards to the set the scores are the same as for the 3-card set.

In delayed recognition the scores are 0, 28, 5, and 0 per cent for the corresponding sets. The differences for the four sets between the scores in delayed and in immediate recognition are 33, 18, 28, and 33 per cent respectively. The result for the 3-card set is rather confusing and should probably be ascribed to an occasionally recurring "absent-mindedness" in the subject, observed in these experiments. The remaining delayed recognition scores differ from the immediate recognition scores at a rate increasing with the number of cards to the set.

In delayed recognition after recall the scores are 100, 5, 14, and 31 per cent respectively. The high score for the 3-card set may possibly be ascribed to a tendency opposite to that recorded in connection with delayed recognition without recall and observed in the experiment. Occasionally, although rarely, the subject would make a rapid selection, being very positive about the results which then usually were correct. The remaining scores show a gradual increase, not found in the scores for immediate recognition, delayed recognition without recall, and recall.

The recall scores are 33, 20, 21, and 11 per cent for the respective sets of cards. With exception of the almost equal scores for 5- and 7-card sets, the scores decline gradually with an increase in items to the set. For 3-card sets the score equals the immediate recognition score, for larger sets it is inferior to the latter.

TABLE XVI

Summary of Experiments with Figures and Variation in Number of Cards. Subject: E n.

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
		1. Immediate Recognition								
V.	3	4	–	–	2	–	6	33	2	
V.	5	23	–	–	7	–	30	53	6	
V.	7	19	–	–	9	–	28	34	4	
V.	9	22	–	–	14	–	36	22	4	16
		2. Delayed Recognition								
V.	3	4	–	–	2	–	6	33	2	
V.	5	19	1	–	10	–	30	32	6	
V.	7	18	–	–	10	–	28	29	4	
V.	9	21	–	–	15	–	36	17	4	16

Total tests 32

Experiments with Figures. Table XVI gives the results in Experiment V. The immediate recognition scores are 33, 53, 34, and 22 per cent for the four sets of cards respectively. Of these the scores for 3- and 7-card sets are identical or almost identical with, those for 5-card sets higher, and those for 3-card sets lower than the corresponding picture scores.

In delayed recognition the scores are 33, 32, 29, and 17 per cent, thus showing a gradually increasing decline with an increasing number of items to the set. We find the following differences between the scores in delayed and in immediate recognition for the four sets respectively: 0, 21, 5, and 5 per cent.

Subject: H-n

Experiments with Pictures. The results obtained in Experiment IV are shown in Table XVII. In immediate recognition the scores are 100 per cent for sets up to and including 15 items and 90 per cent for 20 items.

TABLE XVII

Summary of Experiments with Pictures and Variation in Number of Cards. Subject: H-n.

1. *Immediate Recognition*

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
IV.	5	5	–	–	–	–	5	100	1	
IV.	10	20	–	–	–	–	20	100	2	
IV.	15	15	–	–	–	–	15	100	1	
IV.	20	19	–	–	1	–	20	90	1	5

2. *Recall and Delayed Recognition*

No. of Exp't	No. of Cards	Recall R	Hes. R	Hes. W	W	N	T	Score per cent	Delayed Recognition R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
IV.	5	9	–	–	–	1	10	90	10	–	–	–	–	10	100	2	
IV.	10	12	–	–	–	8	20	60	18	–	–	2	–	20	80	2	
IV.	15	14	–	–	–	16	30	47	28	–	–	2	–	30	87	2	
IV.	20	13	–	–	–	7	20	65	19	–	–	1	–	20	90	1	7

3. *Delayed Recognition*

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
IV.	5	5	–	–	–	–	5	100	1	
IV.	10	20	–	–	–	–	20	100	2	
IV.	15	13	1	–	1	–	15	83	1	
IV.	20	18	–	–	2	–	20	80	1	5

Total tests 17

In delayed recognition the scores are 100, 100, 83, and 80 per cent for sets of 5, 10, 15, and 20 cards respectively. The differences between the scorees in delayed and in immediate recognition are for the four sets respectively: 0, 0, 17, and 10 per cent.

In delayed recognition after recall the scores are 100, 80, 87, and 90 per cent for the respective sets of cards. Comparing these scores with those in delayed recognition without recall we find them equal for 5-card sets; for 10-card sets the former are inferior, and for 15- and 20-card sets increasingly superior. The former scores shows a tendency to rise, the latter to decline with an increase in items beyond 10 to the set.

The recall scores are 90, 60, 47, and 65 per cent for the respective sets. They are inferior to the corresponding scores in immediate recognition, the differences being 10, 40, 53, and 25 per cent respectively. We note a general tendency to decline with an increase in items to the set and an exception to this tendency in the results for 20-card sets. This final rise in the score shows a tendency similar to that found in the scores for delayed recognition after recall.

Experiments with Figures. Table XVIII shows the results in

TABLE XVIII

Summary of Experiments with Figures and Variation in Number of Cards. Subject: H-n.

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
				1. Immediate Recognition						
V.	5	18	–	1	1	–	20	85	4	
V.	10	26	1	2	1	–	30	85	3	
V.	15	27	–	–	3	–	30	80	2	
V.	20	16	–	–	4	–	20	60	1	10
				2. Delayed Recognition						
V.	5	17	–	1	2	–	20	75	4	
V.	10	26	–	1	3	–	30	77	3	
V.	15	26	–	1	3	–	30	77	2	
V.	20	15	–	–	5	–	20	50	1	10
									Total tests	20

Experiment V. The immediate recognition scores are 85, 85, 80, and 60 per cent for the respective sets of cards. They are considerably lower and decline more rapidly than the correspond-

ing scores for pictures, the differences for the four sets respectively being 15, 15, 20, and 30 per cent.

In delayed recognition the scores are 75, 77, 77, and 50 per cent for the respective sets of cards. We note the slight inferiority of the score for 5-card sets to that for 10- and 15-card sets, not found elsewhere with this subject. The differences between the scores in delayed and in immediate recognition for the four sets respectively are 10, 8, 3, and 10 per cent, The average difference for figures is slightly in excess of that for pictures. We note that with pictures the difference is greatest for 15-card sets and absent for 5- and 10-card sets, whereas with figures the greatest differences appear for 5- and 20-card sets and the smallest for 15-card sets.

Subject: D-n

Experiments with Pictures. Table XIX gives the results in

TABLE XIX

Summary of Experiments with Pictures and Variation in Number of Cards. Subject: D-n.

1. *Immediate Recognition*

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
IV.	5	4	–	–	1	–	5	60	1	
IV.	10	24	–	1	5	–	30	63	3	
IV.	15	24	–	1	5	–	30	63	2	
IV.	20	16	–	–	4	–	20	60	1	7

2. *Recall and Delayed Recognition*

No. of Exp't	No. of Cards	Recall R	Hes. R	Hes. W	W	N	T	Score per cent	Delayed Recognition R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
IV.	5	7	–	–	–	3	10	70	9	–	–	1	–	10	80	2	
IV.	10	19	–	–	–	11	30	63	25	–	–	5	–	30	67	3	
IV.	15	12	–	–	–	18	30	40	24	–	–	6	–	30	60	2	
IV.	20	7	–	–	–	13	20	35	15	–	–	5	–	20	50	1	8

3. *Delayed Recognition*

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
IV.	5	4	–	–	1	–	5	60	1	
IV.	10	23	–	1	6	–	30	57	3	
IV.	15	19	–	–	11	–	30	27	2	
IV.	20	12	1	–	7	–	20	28	1	7

Total tests 22

Experiment IV. The immediate recognition scores are 60, 63, 63, and 60 per cent for sets of 5, 10, 15, and 20 cards respectively. There is little variation between the scores, which would indicate that about the same proportion of items is taken in for small as for large sets.

In delayed recognition the scores are 60, 57, 27, and 28 per cent for the respective sets of cards. The differences between the scores in delayed and in immediate recognition for the four sets respectively are 0, 6, 36, and 32 per cent. It would therefore seem that an increase in items beyond 10 to the set greatly reduces retention.

In delayed recognition after recall the scores are 80, 67, 60, and 50 per cent. They are higher throughout and show slightly less decline than those for delayed recognition without recall. The scores for the two smaller sets are higher, those for the two larger sets lower than the corresponding scores for immediate recognition.

The recall scores are 70, 63, 40, and 35 per cent for the respective sets of cards. For 5-card sets the score is higher than, for 10-card sets equal to, and for 15-and 20-card sets lower than that for immediate recognition. The sharpest decline occurs with 15-card sets.

Experiments with Figures. Table XX gives the results obtained in Experiment V. In immediate recognition the scores

TABLE XX

Summary of Experiments with Figures and Variation in Number of Cards

Subject: D-n.

No. of Exp't	No. of Cards	R	Hes. R	Hes. W	W	N	T	Score per cent	No. of Tests	
		1. *Immediate Recognition*								
V.	5	13	–	–	7	–	20	30	4	
V.	10	20	–	1	9	–	30	37	3	
V.	15	19	–	–	11	–	30	27	2	
V.	20	12	–	–	8	–	20	20	1	10
		2. *Delayed Recognition*								
V.	5	11	–	–	8	–	20	20	4	
V.	10	18	–	–	12	–	30	20	3	
V.	15	15	–	–	15	–	30	0	2	
V.	20	10	–	–	10	–	20	0	1	10
									Total tests	20

are 30, 37, 27, and 20 per cent for the respective sets of cards. They are much lower and decline more markedly than the corresponding scores for pictures, the differences for the four sets respectively being 30, 26, 36, and 40 per cent. As with pictures, the score for 5-card sets is slightly inferior to that for 10-card sets.

In delayed recognition the scores are 20, 20, 0, and 0 per cent for the respective sets of cards. The differences between these scores and those for immediate recognition are 10, 17, 27, and 20 per cent respectively, showing the same deterioration in retention with large sets of cards as was found in the scores for pictures.

Figures 3 to 10, pp. 49-52, represent the results obtained in Experiments II to V.

3. Colored Pictures

The experiments with colored pictures (Exp. I and VI) were made partly to accustom the subjects to the method of experimentation, partly for the purpose of ascertaining whether a prolonged period of experimentation had changed the condition of the subjects' memory. The results are given in Table XXI.

Table XXI

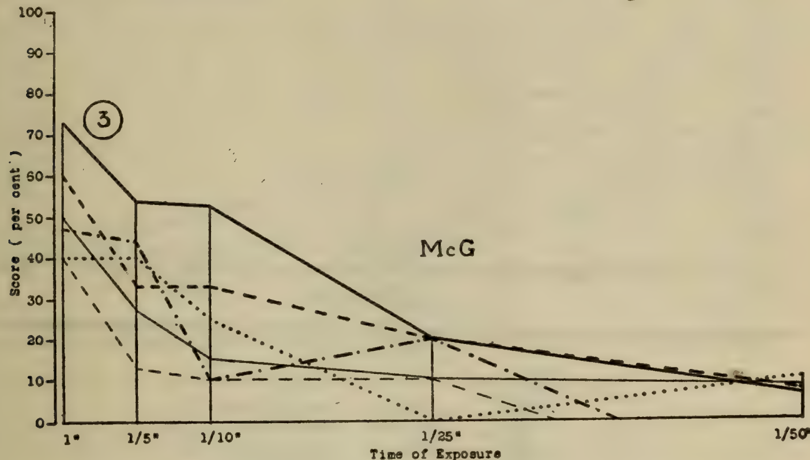
Experiments with Colored Pictures.

The first six columns give per cent score.

Subjects	Immediate Recog. Exp. I	Immediate Recog. Exp. VI	Recall Exp. I	Recall Exp. VI	Delayed Recog. Exp. I	Delayed Recog. Exp. VI	Interval between experiments. - days -
Mc.G.	28	28	60	56	28	12	30
E-n.	36	72	16	20	12	4	47
H-n.	60	100	30	56	60	90	32
D-n.	60	64	55	52	35	62	27

H-n has considerably higher results in Exp. VI than in Exp. I, due probably to the training received in the experimentation. The interval between exposure and selection did not change the results in Exp. I, but a slight change is found in Exp. VI. If we assume that an improvement has taken place, it is probably in the subject's apprehension. *E-n* shows a similar improvement in apprehension, although his results for delayed recognition in Exp. VI are inferior to those in Exp. I. The slightly higher

results of *D-n* for recognition in Exp. VI over those in Exp. I are probably sufficiently explained by an increased familiarity with the experiment. She shows no improvement in recall. The reduced results of *McG* for recall and for delayed recognition in Exp. VI may be interpreted to indicate at least that no improvement has taken place.



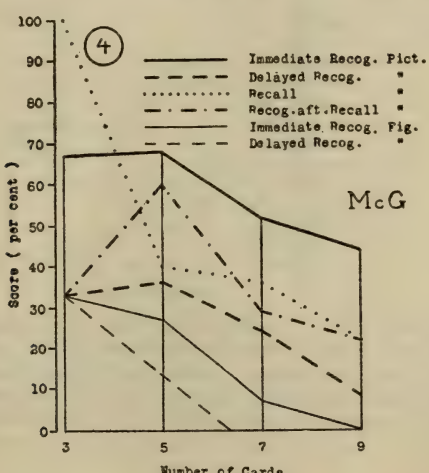
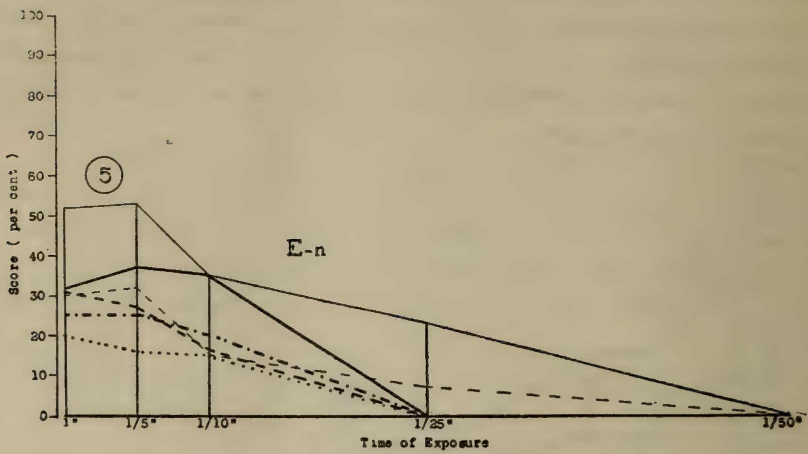


Fig. 3.—Subject: McG. Variation in Time of Exposure.
Fig. 4.—Subject: McG. Variation in Number of Cards.
Both figures give the results in immediate recognition, delayed recognition, recall, and delayed recognition after recall with pictures, and in immediate and in delayed recognition with figures. Per cent score.



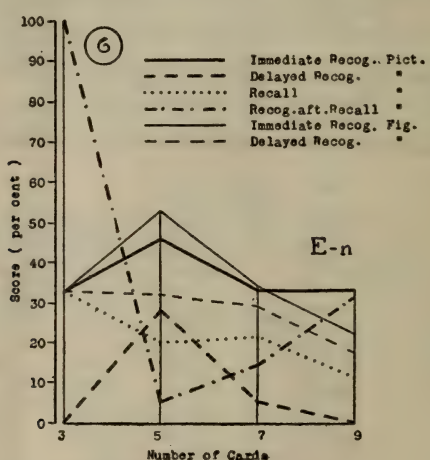
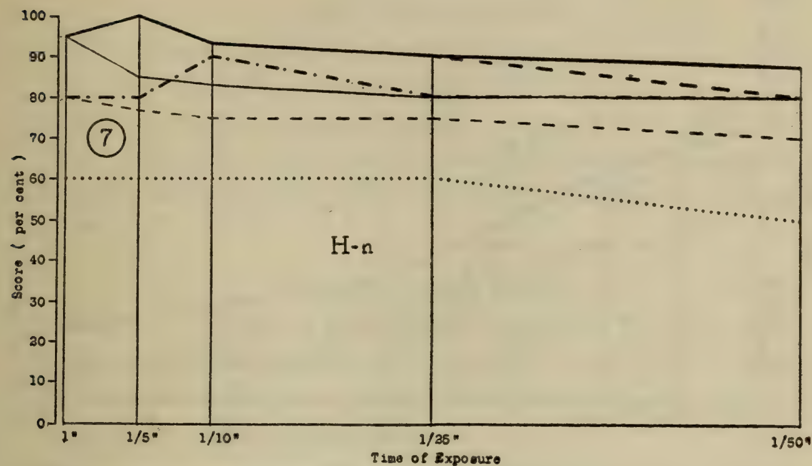


FIG. 5.—Subject: E-n. Variation in Time of Exposure.
FIG. 6.—Subject: E-n. Variation in Number of Cards.

Both figures give the results in immediate recognition, delayed recognition, recall, and delayed recognition after recall with pictures, and in immediate and in delayed recognition with figures. Per cent score.



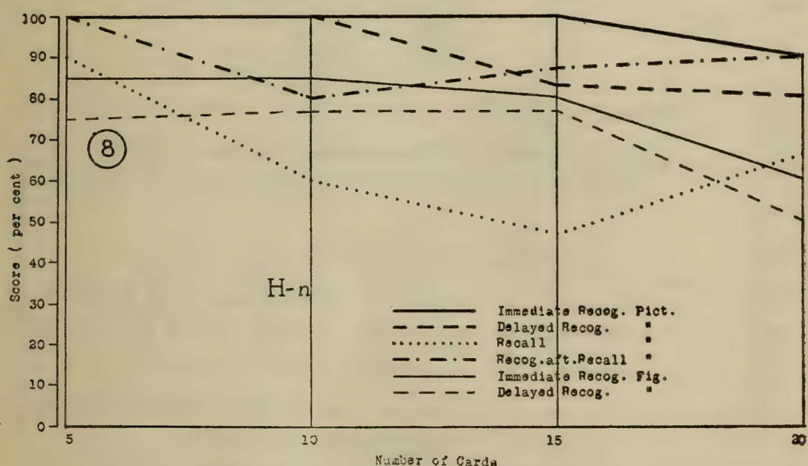
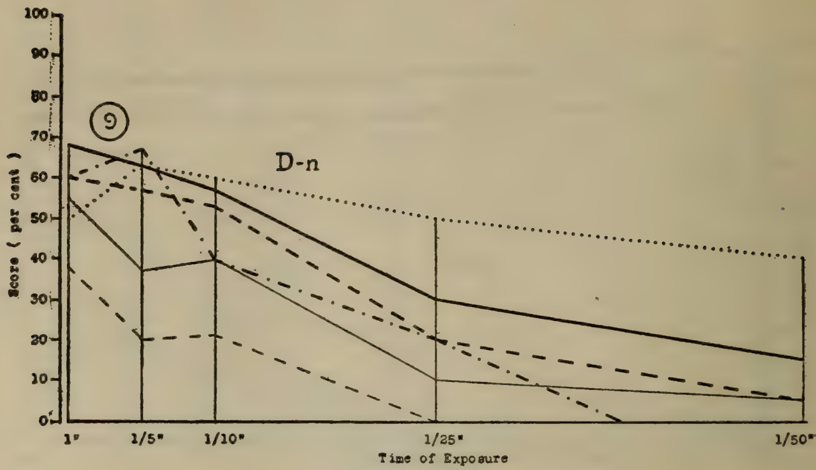


FIG. 7.—Subject: H-n. Variation in Time of Exposure.
FIG. 8.—Subject: H-n. Variation in Number of Cards.

Both figures give the results in immediate recognition, delayed recognition, recall, and delayed recognition after recall with pictures, and in immediate and in delayed recognition with figures. Per cent score.



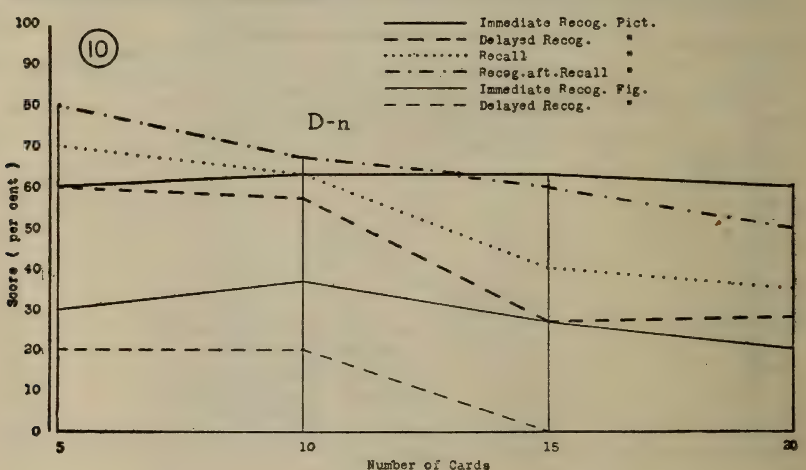


Fig. 9.—Subject: D-n. Variation in Time of Exposure.
Fig. 10.—Subject: D-n. Variation in Number of Cards.

Both figures give the results in immediate recognition, delayed recognition, recall, and delayed recognition after recall with pictures, and in immediate and in delayed recognition with figures. Per cent score.

4. Repeated and Intervening Stimuli

A. Repeated Stimuli

The results in Experiment VII (Tables XXII and XXIII) show that with *H-n* a second exposure of the cards improves the results; subsequent exposures seem to have little or no effect. With *D-n* each of the four repetitions increases the results; the greatest increases occur with the second and the fourth repetitions.

B. Intervening Stimuli

Tables XXIV and XXV give the results in Experiment VIII. Comparing these with the corresponding results in Experiment VII (Tables XXII and XXIII) we find the following differences between the respective scores:

Presentations	*H-n*	*D-n*
1.	37%	23%
2.	33%	22%
3.	34%	5%
4.	26%	18%

In both subjects the intervening stimulation interferes with recall memory, but this interference decreases with a continued repetition of both primary and secondary stimuli.

5. Primacy and Recency

Tables XXVI-XXIX show the distribution of correct selections in relation to the order of exposure of the cards. They include only the results of experiments with the "normal" sets of 5 and 10 cards respectively.

McG. In immediate recognition of pictures the last two cards are most frequently selected, the first and the third least frequently. In delayed recognition of pictures the third and the last are most frequently, the first less frequently selected. In immediate recognition of figures the last card is most frequently selected, next in order of frequency the third, and last the first with the fourth card a close second. In delayed recognition of figures the variation is very insignificant. With this subject recency therefore influences selection favorably in immediate recognition, both

TABLE XXII

Experiments with Pictures. Four successive tests in which each picture is exposed for 1/5″. In the first test a set of 7 pictures is presented, to which is added 1 picture for each succeeding test. Recall 2 minutes after each presentation. Five experiments with four tests each.

Subject: H-n

Test no.	Selections			Score
	R	W	T	Per cent
1.	32	–	35	91
2.	39	–	40	98
3.	44	–	45	98
4.	48	–	50	96

TABLE XXIII

Experiments with Pictures. Four successive tests in which each picture is exposed for 1/5″. In the first test a set of 7 pictures is presented, to which is added 1 picture for each succeeding test. Recall 2 minutes after each presentation. Five experiments with four tests each.

Subject: D-n

Test no.	Selections			Score
	R	W	T	Per cent
1.	20	–	35	57
2.	30	–	40	75
3.	34	–	45	76
4.	44	–	50	88

TABLE XXIV

Experiments with Pictures. Four successive tests in which each picture is exposed for 1/5″. In the first test a set of 7 pictures is presented, to which is added 1 picture for each succeeding test. Each test is followed with an interval of 30″ by a secondary test with Colored Pictures arranged and exposed as the pictures in the primary test. Recall 2 minutes after each presentation in the primary test. Five experiments with four double tests each.

Subject: H-n

Test no.	Selections			Score
	R	W	T	Per cent
1.	24	5	35	54
2.	33	7	40	65
3.	33	4	45	64
4.	41	6	50	70

TABLE XXV

Experiments with Pictures. Four successive tests in which each picture is exposed for 1/5″. In the first test a set of 7 pictures is presented, to which is added 1 picture for each succeeding test. Each test is followed with an interval of 30″ by a secondary test with Colored Pictures arranged and exposed as the pictures in the primary test. Recall 2 minutes after each presentation in the primary test. Five experiments with four double tests each.

Subject: D-n

Test no.	Selections			Score
	R	W	T	Per cent
1.	12	–	35	34
2.	21	–	40	53
3.	32	–	45	71
4.	35	–	50	70

Table XXVI

Distribution of Selections

Computed from experiments with pictures (P) and figures (F) in which 5 cards are exposed in succession.

Recognition (Rg) *and Retention* (Rt).

Subject: McG

Order of Expos.		1st P	1st F	1st T	2d P	2d F	2d T	3d P	3d F	3d T	4th P	4th F	4th T	5th P	5th F	5th T	Tot. P	Tot. F	Tot.
		Order of Selection																	
1st	Rg	2	2	4	4	2	6	6	2	8	1	2	3	3	2	5	16	10	26
	Rt	8	3	11	1	3	4	4	2	6	1	5	6	2	2	4	16	15	31
	T	10	5	15	5	5	10	10	4	14	2	7	9	5	4	9	32	25	57
2d	Rg	3	–	3	8	6	14	1	3	4	3	3	6	5	2	7	20	14	34
	Rt	2	4	6	5	–	5	1	4	5	8	3	11	3	3	6	19	14	33
	T	5	4	9	13	6	19	2	7	9	11	6	17	8	5	13	39	28	67
3d	Rg	1	–	1	5	6	11	3	4	7	5	4	9	3	5	8	17	19	36
	Rt	5	5	10	2	3	5	4	2	6	5	1	6	5	3	8	21	14	35
	T	6	5	11	7	9	16	7	6	13	10	5	15	8	8	16	38	33	71
4th	Rg	1	–	1	6	3	9	7	4	11	5	1	6	6	4	10	25	12	37
	Rt	2	2	4	8	3	11	4	2	6	1	7	8	4	1	5	19	15	34
	T	3	2	5	14	6	20	11	6	17	6	8	14	10	5	15	44	27	71
5th	Rg	17	20	37	3	1	4	3	–	3	1	3	4	2	–	2	26	24	50
	Rt	10	4	14	2	5	7	2	4	6	3	1	4	3	–	3	20	14	34
	T	27	24	51	5	6	11	5	4	9	4	4	8	5	–	5	46	38	84
Tot.	Rg	24	22	46	26	18	44	20	13	33	15	13	28	19	13	32	104	79	183
	Rt	27	18	45	18	14	32	15	14	29	18	17	35	17	9	26	95	72	167
Total		51	40	91	44	32	76	35	27	62	33	30	63	36	22	58	199	151	350

Order of Expos.	Pictures Rg	pc	Pictures Rt	pc	Pictures T	pc	Figures Rg	pc	Figures Rt	pc	Figures T	pc	Total	pc
	Selections													
1st	16	53	16	53	32	53	10	38	15	58	25	48	57	51
2d	20	67	19	63	39	65	14	54	14	54	28	54	67	60
3d	17	57	21	70	38	64	19	73	14	54	33	64	71	63
4th	25	83	19	63	44	73	12	46	15	58	27	52	71	63
5th	26	87	20	67	46	77	24	92	14	54	38	73	84	75
Total	104		95		199		79		72		151		350	
Total pc		69		63		66		61		55		58		62

Total Pictures exposed: Rg. 150 — Rt. 150 — total 300
Total Figures exposed: Rg. 130 — Rt. 130 — total 260
Total Cards exposed: Rg. 280 — Rt. 280 — total 560
Total Pictures selected: Rg. 104 — Rt. 95 — total 199
Total Figures selected: Rg. 79 — Rt. 72 — total 151
Total Cards selected: Rg. 183 — Rt. 167 — total 350

Table XXVII

Distribution of Selections

Computed from experiments with pictures (P) and figures (F) in which 5 cards are exposed in succession.

Recognition (Rg) and *Retention* (Rt)

Subject: E-n

Order of Expos.		1st P	1st F	1st T	2d P	2d F	2d T	3d P	3d F	3d T	4th P	4th F	4th T	5th P	5th F	5th T	Tot. P	Tot. F	Tot.
1st	Rg	3	1	4	4	2	6	4	5	9	1	5	6	7	6	13	19	19	38
	Rt	4	1	5	2	2	4	2	3	5	2	4	6	3	5	8	13	15	28
	T	7	2	9	6	4	10	6	8	14	3	9	12	10	11	21	32	34	66
2d	Rg	4	–	4	6	10	16	4	3	7	5	2	7	–	–	–	19	15	34
	Rt	3	3	6	2	7	9	4	2	6	2	3	5	2	1	3	13	16	29
	T	7	3	10	8	17	25	8	5	13	7	5	12	2	1	3	32	31	63
3d	Rg	4	1	5	3	5	8	4	2	6	5	3	8	2	5	7	18	16	34
	Rt	3	2	5	2	6	8	4	3	7	3	2	5	3	1	4	15	14	29
	T	7	3	10	5	11	16	8	5	13	8	5	13	5	6	11	33	30	63
4th	Rg	1	3	4	3	3	6	5	3	8	4	5	9	3	2	5	16	16	32
	Rt	5	3	8	2	3	5	4	4	8	4	1	5	1	4	5	16	15	31
	T	6	6	12	5	6	11	9	7	16	8	6	14	4	6	10	32	31	63
5th	Rg	14	18	32	4	–	4	3	2	5	2	1	3	1	1	2	24	22	46
	Rt	6	5	11	4	–	4	1	3	4	3	5	8	2	2	4	16	15	31
	T	20	23	43	8	–	8	4	5	9	5	6	11	3	3	6	40	37	77
Tot.	Rg	26	23	49	20	20	40	20	15	35	17	16	33	13	14	27	96	88	184
	Rt	21	14	35	12	18	30	15	15	30	14	15	29	11	13	24	73	75	148
Total		47	37	84	32	38	70	35	30	65	31	31	62	24	27	51	169	163	332

Order of Expos.	Pictures Rg	pc	Pictures Rt	pc	Pictures T	pc	Figures Rg	pc	Figures Rt	pc	Figures T	pc	Total	pc
1st	19	63	13	43	32	53	19	73	15	58	34	65	66	59
2d	19	63	13	43	32	53	15	58	16	62	31	60	63	56
3d	18	60	15	50	33	55	16	62	14	54	50	58	63	56
4th	16	53	16	53	32	53	16	62	15	58	31	60	63	56
5th	24	80	16	53	40	67	22	85	15	58	37	71	77	69
Total	96		73		169		88		75		163		332	
Tot. pc		62		49		56		68		60		63		60

Total Pictures exposed: Rg. 150 — Rt. 150 — total 300
Total Figures exposed: Rg. 130 — Rt. 130 — total 260
Total Cards exposed: Rg. 280 — Rt. 280 — total 560

Total Pictures selected: Rg. 96 — Rt. 73 — total 169
Total Figures selected: Rg. 88 — Rt. 75 — total 163
Total Cards selected: Rg. 184 — Rt. 148 — total 332

TABLE XXVIII

Distribution of Selections

Computed from experiments with pictures (P) and figures (F) in which 10 cards are exposed in succession.

Recognition (Rg) and *Retention* (Rt).

Subject: H-n

Order of Expos.		Order of Selections: 1st P	1st F	1st T	2d P	2d F	2d T	3d P	3d F	3d T	4th P	4th F	4th T	5th P	5th F	5th T	6th P	6th F	6th T	7th P	7th F	7th T	8th P	8th F	8th T	9th P	9th F	9th T	10th P	10th F	10th T	Tot. P	Tot. F	Tot.
1st	Rg	–	1	1	3	2	5	–	–	–	2	2	4	2	3	5	–	1	1	3	–	3	3	–	3	4	1	5	3	1	4	20	11	31
	Rt	–	1	1	–	1	1	2	3	5	1	4	5	7	2	9	2	–	2	3	–	3	3	–	3	–	–	–	3	–	3	21	11	32
	T	–	2	2	3	3	6	2	3	5	3	6	9	9	5	14	2	1	3	6	–	6	6	–	6	4	1	5	6	1	7	41	22	63
2d	Rg	3	3	6	2	2	4	2	1	3	–	–	–	4	2	6	3	–	3	1	–	1	3	–	3	–	–	–	1	1	2	19	9	28
	Rt	6	3	9	3	3	6	3	2	5	1	–	1	3	1	4	3	–	3	–	–	–	2	–	2	–	–	–	1	–	1	22	9	31
	T	9	6	15	5	5	10	5	3	8	1	–	1	7	3	10	6	–	6	1	–	1	5	–	5	–	–	–	2	1	3	41	18	59
3d	Rg	–	–	–	1	–	1	3	6	9	3	3	6	–	2	2	1	–	1	3	–	3	1	2	3	4	–	4	3	–	3	19	13	32
	Rt	1	–	1	3	2	5	1	3	4	4	4	8	2	1	3	–	1	1	–	–	–	2	–	2	1	–	1	3	–	3	17	11	28
	T	1	–	1	4	2	6	4	9	13	7	7	14	2	3	5	1	1	2	3	–	3	3	2	5	5	–	5	6	–	6	36	24	60
4th	Rg	1	1	2	–	2	2	1	1	2	1	2	3	2	3	5	2	2	4	1	1	2	6	–	6	4	1	5	3	–	3	21	13	34
	Rt	1	2	3	3	1	4	1	2	3	1	1	2	1	5	6	5	1	6	1	–	1	5	–	5	2	–	2	1	–	1	21	12	33
	T	2	3	5	3	3	6	2	3	5	2	3	5	3	8	11	7	3	10	2	1	3	11	–	11	6	1	7	4	–	4	42	25	67
5th	Rg	19	5	24	–	1	1	–	–	–	–	2	2	–	2	2	–	–	–	–	–	–	–	–	–	–	1	1	1	–	1	20	11	31
	Rt	12	6	18	1	1	2	1	1	2	1	2	3	–	1	1	–	–	–	3	–	3	–	–	–	3	–	3	–	–	–	21	11	32
	T	31	11	42	1	2	3	1	1	2	1	4	5	–	3	3	–	–	–	3	–	3	–	–	–	3	1	4	1	–	1	41	22	63
6th	Rg	–	1	1	–	–	–	3	–	3	1	–	1	2	1	3	4	3	10	6	2	8	2	1	3	2	2	4	1	2	3	21	12	33
	Rt	1	–	1	–	–	–	1	–	1	–	–	–	2	1	3	3	–	3	5	2	7	2	4	6	4	1	5	2	5	7	20	13	33
	T	1	1	2	–	–	–	4	–	4	1	–	1	4	2	6	7	3	13	11	4	15	4	5	9	6	3	9	3	7	10	41	25	66
7th	Rg	–	–	–	11	2	13	5	–	5	–	–	–	1	–	1	–	3	3	–	5	5	1	2	3	1	–	1	1	1	2	20	13	33
	Rt	–	1	1	7	1	8	4	–	4	4	–	4	2	–	2	3	9	12	1	–	1	–	1	1	–	–	–	1	–	1	22	12	34
	T	–	1	1	18	3	21	9	–	9	4	–	4	3	–	3	3	12	15	1	5	6	1	3	4	1	–	1	2	1	3	42	25	67
8th	Rg	–	–	–	–	1	1	2	1	3	5	–	5	–	–	–	5	2	7	2	3	5	2	1	3	2	1	3	3	3	6	21	12	33
	Rt	–	–	–	3	–	3	–	–	–	2	–	2	–	–	–	–	–	–	4	8	12	4	2	6	1	1	2	2	–	2	16	11	27
	T	–	–	–	3	1	4	2	1	3	7	–	7	–	–	–	5	2	7	6	11	17	6	3	9	3	2	5	5	3	8	37	23	60
9th	Rg	–	–	–	–	–	–	–	–	–	3	2	5	3	–	3	5	2	7	3	1	4	1	2	3	1	4	5	3	2	5	19	13	32
	Rt	–	–	–	–	–	–	2	–	2	1	–	1	–	–	–	5	1	6	4	–	4	1	2	3	3	8	11	2	–	2	18	11	29
	T	–	–	–	–	–	–	2	–	2	4	2	6	3	–	3	10	3	13	7	1	8	2	4	6	4	12	16	5	2	7	37	24	61
10th	Rg	–	–	–	2	–	2	4	2	6	4	1	5	6	–	6	–	–	–	1	–	1	2	4	6	2	2	4	–	2	2	21	11	32
	Rt	–	–	–	–	–	–	3	–	3	6	–	6	3	–	3	–	1	1	–	1	1	1	3	4	3	1	4	3	5	8	21	11	32
	T	–	–	–	2	–	2	7	2	9	10	1	11	9	–	9	–	1	1	1	1	2	3	7	10	5	3	8	3	7	10	42	22	64
Tot.	Rg	23	11	44	19	10	29	20	11	31	19	12	32	20	13	33	20	13	33	20	12	32	21	12	33	20	12	32	19	12	31	201	118	319
	Rt	22	13	35	20	9	29	18	11	29	21	11	32	20	11	31	21	13	34	21	11	32	20	12	32	17	11	28	18	10	28	198	112	310
Total		45	24	79	39	19	58	38	22	60	40	23	64	40	24	64	41	26	67	41	23	64	41	24	65	37	23	60	37	22	59	399	230	629

TABLE XXVIII (Continued)

Distribution of Selections

Computed from experiments with pictures (P) and figures (F) in which 10 cards are exposed in succession.

Recognition (Rg) and *Retention* (Rt)
Subject: H-n

Order of Expos.	Pictures Rg		Rt		T		Figures Rg		Rt		T		Total	
		pc		pc		pc		pc		pc		pc		pc
1st	20	87	21	91	41	89	11	85	11	85	22	85	63	87
2d	19	83	22	96	41	89	9	69	9	69	18	69	59	79
3d	19	83	17	74	36	78	13	100	11	85	24	92	60	83
4th	21	91	21	91	42	91	13	100	12	92	25	96	67	93
5th	20	87	21	91	41	89	11	85	11	85	22	85	63	87
6th	21	91	20	87	41	89	12	92	13	100	25	96	66	92
7th	20	87	22	96	42	91	13	100	12	92	25	96	67	93
8th	21	91	16	70	37	80	12	92	11	85	23	90	60	83
9th	19	83	18	78	37	80	13	100	11	85	24	92	61	85
10th	21	91	20	87	41	89	11	85	11	85	22	85	63	87
Total	201		198		399		118		112		230		629	
Total pc.		87		86		87		91		86		88		87

Total Pictures exposed: Rg 230 — Rt 230 — total 460
Total Figures exposed: Rg 130 — Rt 130 — total 260
Total Cards exposed: Rg 360 — Rt 360 — total 720

Total Pictures selected: Rg 201 — Rt 198 — total 399
Total Figures selected: Rg 118 — Rt 112 — total 230
Total Cards selected: Rg 319 — Rt 310 — total 629

TABLE XXIX

Distribution of Selections

Computed from experiments with pictures (P) and figures (F) in which 10 cards are exposed in succession.
Recognition (Rg) and *Retention* (Rt).
Subject: D-n

Order of Expos.		Order of Selections 1st P	F	T	2d P	F	T	3d P	F	T	4th P	F	T	5th P	F	T	6th P	F	T	7th P	F	T	8th P	F	T	9th P	F	T	10th P	F	T	Tot. P	F	Tot.
1st	Rg	1	–	1	4	1	5	3	1	4	2	2	4	1	1	2	1	–	1	–	–	–	2	2	4	1	–	1	–	–	–	15	7	22
	Rt	1	3	4	1	1	2	4	1	5	3	1	4	1	–	1	1	1	2	–	1	1	2	–	2	2	–	2	–	–	–	15	8	23
	T	2	3	5	5	2	7	7	2	9	5	3	8	2	1	3	2	1	3	–	1	1	4	2	6	3	–	3	–	–	–	30	15	45
2d	Rg	2	2	4	1	2	3	4	–	4	3	–	3	2	–	2	1	2	3	–	2	2	1	–	1	1	–	1	–	1	1	15	9	24
	Rt	3	–	3	4	2	6	2	–	2	1	–	1	2	–	2	1	–	1	–	–	–	1	1	2	1	–	1	–	–	–	14	3	17
	T	5	2	7	5	4	9	6	–	6	4	–	4	4	–	4	2	2	4	–	2	2	2	1	3	2	–	2	–	1	1	29	12	41
3d	Rg	3	1	4	1	2	3	2	2	4	2	2	4	2	1	3	2	1	3	1	–	1	–	–	–	1	–	1	–	–	–	14	9	23
	Rt	3	–	3	1	–	1	2	2	4	2	3	5	1	1	2	1	2	3	3	–	3	2	–	2	–	1	1	–	–	–	15	9	24
	T	6	1	7	2	2	4	4	4	8	4	5	9	3	2	5	3	3	6	4	–	4	2	–	2	1	1	2	–	–	–	29	18	47
4th	Rg	3	1	4	1	2	3	–	1	1	1	–	1	1	2	3	1	–	1	1	2	3	2	–	2	–	–	–	–	–	–	10	9	19
	Rt	1	3	4	3	3	6	1	2	3	2	1	3	1	1	2	1	–	1	–	–	–	1	–	–	–	–	–	2	–	2	12	10	22
	T	4	4	8	4	5	9	1	3	4	3	1	4	2	3	5	2	–	2	1	2	3	3	–	2	–	–	–	2	–	2	22	19	41
5th	Rg	2	1	3	3	–	3	1	2	3	1	1	2	2	1	3	2	1	3	–	1	1	–	–	–	–	1	1	1	–	1	12	8	20
	Rt	3	1	4	2	3	5	–	2	2	3	1	4	1	1	2	2	–	2	1	–	1	2	–	2	2	1	3	–	1	1	16	10	26
	T	5	2	7	5	3	8	1	4	5	4	2	6	3	2	5	4	1	5	1	1	2	2	–	2	2	2	4	1	1	2	28	18	46
6th	Rg	–	–	–	1	2	3	2	2	4	–	1	1	2	1	3	3	–	3	2	–	2	2	–	2	1	1	2	1	–	1	14	7	21
	Rt	2	–	2	–	1	1	2	–	2	3	1	4	4	–	4	2	–	2	–	–	–	–	2	2	1	2	3	–	–	–	14	6	20
	T	2	–	2	1	3	4	4	2	6	3	2	5	6	1	7	5	–	5	2	–	2	2	2	4	2	3	5	1	–	1	28	13	41
7th	Rg	1	1	2	2	1	3	1	–	1	1	1	2	1	1	2	2	–	2	2	1	3	–	2	2	2	–	2	–	2	2	12	9	21
	Rt	4	1	5	2	–	2	–	–	–	–	1	1	–	–	–	1	2	3	–	–	–	2	3	5	–	–	–	1	–	1	10	7	17
	T	5	2	7	4	1	5	1	–	1	1	2	3	1	1	2	3	2	5	2	1	3	2	5	7	2	–	2	1	2	3	22	16	38
8th	Rg	–	1	1	2	–	2	1	–	1	2	1	3	–	1	1	2	1	3	2	1	3	1	–	1	2	–	2	1	–	1	13	7	20
	Rt	–	1	1	2	–	2	1	–	1	–	–	–	1	1	2	3	2	5	2	1	3	1	1	2	–	–	–	1	–	1	11	6	17
	T	–	2	2	4	–	4	2	–	2	2	1	3	1	2	3	5	3	8	4	2	6	2	1	3	2	–	2	2	–	2	24	13	37
9th	Rg	–	–	–	2	–	2	1	3	4	1	–	1	1	–	1	1	–	1	3	–	3	2	1	3	1	1	2	4	–	4	16	5	21
	Rt	1	1	2	–	–	–	2	–	2	–	–	–	3	1	4	1	1	2	3	1	4	1	–	1	–	1	1	1	1	2	12	6	18
	T	1	1	2	2	–	2	3	3	6	1	–	1	4	1	5	2	1	3	6	1	7	3	1	4	1	2	3	5	1	6	28	11	39
10th	Rg	6	3	9	–	1	1	–	–	–	2	–	2	2	1	3	1	–	1	1	–	1	1	1	2	–	–	–	–	1	1	13	7	20
	Rt	–	–	–	1	–	1	1	–	1	1	–	1	–	–	–	3	–	3	1	–	1	–	1	1	1	–	1	–	1	1	8	3	11
	T	6	3	9	1	1	2	1	–	1	3	–	3	3	1	3	4	–	4	2	–	2	1	2	3	1	–	1	–	2	2	21	10	31
Tot.	Rg	18	10	28	17	11	28	15	11	26	15	8	23	14	9	23	16	5	21	12	7	19	11	6	17	9	5	14	7	5	12	134	77	211
	Rt	18	10	28	16	10	26	15	7	22	15	8	23	14	5	19	15	8	23	10	4	14	11	8	19	7	5	12	6	3	9	127	68	195
Total		36	20	56	33	21	54	30	18	48	30	16	46	28	14	42	31	13	44	22	11	33	22	14	36	16	10	26	23	8	21	261	145	406

TABLE XXIX (Continued)

Distribution of Selections

Computed from experiments with pictures (P) and figures (F) in which 10 cards are exposed in succession.

Recognition (Rg) and *Retention* (Rt)

Subject: D-n

Order of Expos.	Pictures Rg		Pictures Rt		Pictures T		Figures Rg		Figures Rt		Figures T		Total	
		pc		pc		pc		pc		pc		pc		pc
1st	15	83	15	83	30	83	7	54	8	62	15	58	45	71
2d	15	83	14	78	29	81	9	69	3	23	12	46	41	66
3d	14	78	15	83	29	81	9	69	9	69	18	69	47	76
4th	10	56	12	67	22	61	9	69	10	77	19	73	41	66
5th	12	67	16	89	28	78	8	62	10	77	18	69	46	74
6th	14	78	14	78	28	78	7	54	6	46	13	50	41	66
7th	12	67	10	56	22	61	9	69	7	54	16	62	38	61
8th	13	72	11	61	24	67	7	54	6	46	13	50	37	60
9th	16	89	12	67	28	78	5	38	6	46	11	42	39	63
10th	13	72	8	44	21	58	7	54	3	23	10	38	31	50
Total	134		127		261		77		68		145		406	
Total pc.		74		71		73		59		52		56		65

Total Pictures exposed:	Rg 180 — Rt 180 — total 360
Total Figures exposed:	Rg 130 — Rt 130 — total 260
Total Cards exposed:	Rg 310 — Rt 310 — total 620
Total Pictures selected:	Rg 134 — Rt 127 — total 261
Total Figures selected:	Rg 77 — Rt 68 — total 146
Total Cards selected:	Rg 211 — Rt 195 — total 406

of pictures and of figures. In delayed recognition this influence is not apparent. In immediate as well as in delayed recognition of pictures, and in immediate recognition of figures, the first item is least well remembered.

E-n. In immediate recognition of pictures the last card is most frequently selected, next the first and the second, and least frequently the fourth card. In delayed recognition of pictures the fourth and the fifth cards are most frequently selected, least frequently the first and the second cards. In immediate recognition of figures the last card is most frequently selected, next, the first, and least frequently the second card. In delayed recognition with figures the distribution of selections is more even, the second card being selected most, and the third least frequently. Hence, with this subject, recency and in less degree primacy have a favorable influence on selection in immediate recognition both of pictures and of figures. Recency has a favorable, and primacy an unfavorable influence on selection in delayed recognition of pictures; in delayed recognition of figures no such influence is evident.

H-n. Both in immediate and in delayed recognition of pictures as well as of figures the selections are fairly evenly distributed over the various items in the set, and there is therefore no marked influence of primacy and recency with this subject.

D-n. In delayed recognition of both materials the last card is selected with decreased frequency. In immediate recognition this is less apparent. In the added results for immediate and for delayed recognition of pictures the first card in order of presentation is most frequently, and the last card least frequently selected. In the added results for immediate and for delayed recognition of figures the last card is least frequently selected. It would seem, then, that with this subject recency has a slightly unfavorable influence on selection, more marked in delayed than in immediate recognition. The added results for pictures may indicate that primacy has a slightly favorable influence on selection.

VI. COMPARISONS AND CONCLUSIONS

1. Apprehension

There is a general difference in apprehension between the various subjects which will be dealt with under the subsequent subheading.

Both stimulation time and the character of the material affect apprehension in the defective subjects.

Table XXX[1] and Figure 11 show the relation between the aver-

Table XXX

Experiments with Pictures and Variation in Time of Exposure

Immediate Recognition

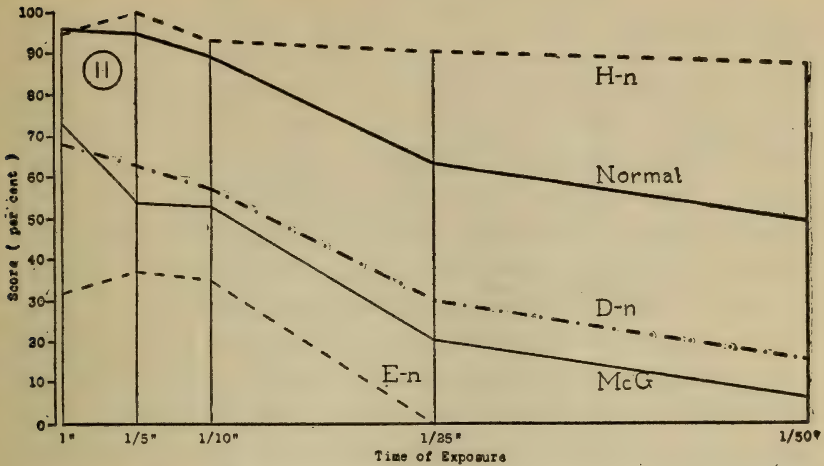
	Time of Exposure (per cent score)					Total Decline	
						Absolute	Relative
	1″	1/5″	1/10″	1/25″	1/50″	(per cent score)	(per cent)
"Normal"	96	95	89	63	49	47	49
H-n	95	100	93	90	87	13	13
D-n	68	63	57	30	15	53	78
McG	73	54	53	20	6	67	92
E-n	32	37	35	—	—	37	100

age scores for normal subjects and the scores for the defective subjects in immediate recognition of pictures. Comparing these scores we find that H-n has the highest general average as well as the greatest stability[2] which also is greater than in any of the individual normal scores. The scores of D-n are inferior to the normal both in general average and in stability, and similarly those of McG which are inferior also to those of D-n. E-n has the lowest scores; the small difference between his three scores indicates that his apprehension is poor regardless of the stimulation time.

Table XXI and Figure 12 show the relation between the average scores for normal subjects and the scores for the defective subjects in immediate recognition of figures. The scores of H-n are superior to the average normal both as regards general aver-

[1] The "relative decline" in tables XXX-XXXVII is measured in percentage of the highest score.

[2] We measure stability in terms of relative decline.



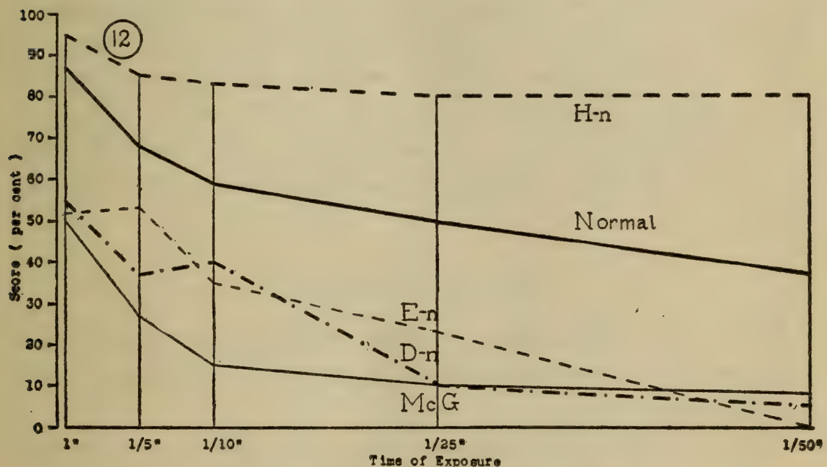


FIG. 11.—Pictures. Variation in Time of Exposure. Per cent score.
FIG. 12.—Figures. Variation in Time of Exposure. Per cent score.

Both figures show the average results for the normal subjects and the individual results for the defective subjects.

TABLE XXXI

Experiments with Figures and Variation in Time of Exposure

Immediate Recognition

	Time of Exposure (per cent score)					Total Decline	
	1"	1/5"	1/10"	1/25"	1/50"	Absolute (per cent score)	Relative (per cent)
"Normal"	87	68	59	50	37	50	58
H-n	95	85	83	80	80	15	16
D-n	55	37	40	10	5	50	91
McG	50	27	15	10	8	42	84
E-n	52	53	35	23	—	53	100

age and stability, moreover, they show greater stability than any individual normal series of scores (*cf.* Table II). The scores of D-n are inferior to the normal both as regards general average and stability. The scores of McG are further inferior to the normal in general average, although they show somewhat greater stability than those of D-n. The general average for E-n is slightly superior to that for D-n but inferior to the normal. If, however, we compare his first four scores with those of D-n and of McG, we find a greater stability in the scores of E-n.

Thus it may be concluded that pictures offer greater facility for apprehension than figures with normal subjects and with H-n, D-n, and McG, but in the case of E-n the reverse is true. Apprehension declines with a gradual reduction in the time of exposure, more rapidly with figures than with pictures in most cases, but more rapidly with pictures than with figures in the case of McG. The least decline is shown by H-n, both with pictures and with figures; the other defective subjects show greater relative decline than is found in the average normal results with both materials. E-n shows the greatest decline with both materials. D-n shows the next greatest decline with figures, and McG with pictures.

2. Span of Memory

Under this sub-heading we shall deal with the results in experiments for immediate recognition and with variation in number of cards.

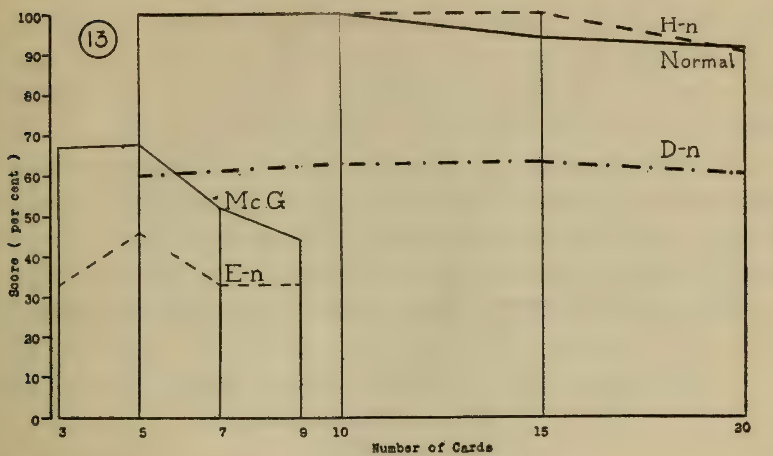
Table XXXII and Figure 13 show the relation between the

Table XXXII

Experiments with Pictures and Variation in Number of Cards

Immediate Recognition

	Number of Cards (per cent score)					Total Decline	
	3	5	7	9	(—)	Absolute	Relative
	5	10	15	20	(25)	(per cent score)	(per cent)
"Normal"	100	100	94	91	(87)	9	9
H-n	100	100	100	90	(—)	10	10
D-n	60	63	63	60	(—)	3	5
McG	67	68	52	44	(—)	24	35
E-n	33	46	33	33	(—)	13	28



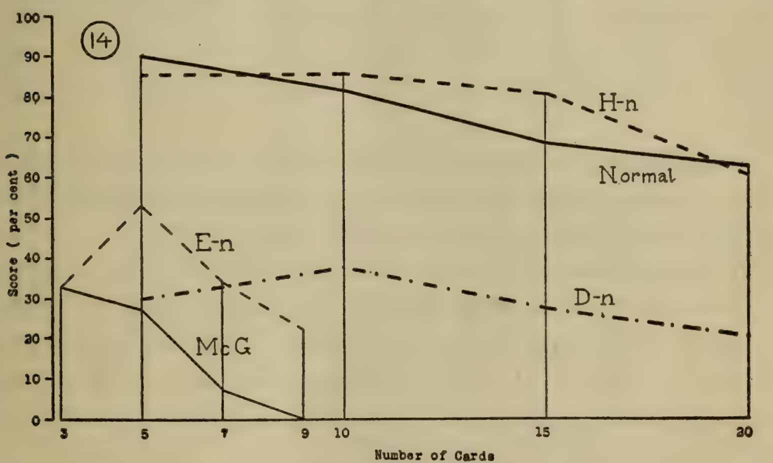


FIG. 13.—Pictures. Variation in Number of Cards. Per cent score.
FIG. 14.—Figures. Variation in Number of Cards. Per cent score.

Both figures show the average results for the normal subjects and the individual results for the defective subjects.

average scores for normal subjects and the scores for the defective in experiments with pictures. In each series of scores the highest results are reached with the "normal" set of cards. The results of H-n are on a par with the average normal results, those of McG and of D-n are considerably, and those of E-n greatly, below the normal. With an increased number of cards to the set

the score of H-n declines more sharply than the normal score. The average decline in his score is slightly greater than that in the normal. The decline in the score of D-n is much smaller than that in the normal, giving the impression that within the limits of the experiment she is able to recognize a more or less constant proportion of items. The score of McG shows the greatest absolute as well as relative decline. The score of E-n is constant with exception for the relatively high figure for the "normal" set.

Table XXXIII and Figure 14 show the relation between the

TABLE XXXIII

Experiments with Figures and Variation in Number of Cards

Immediate Recognition

	Number of Cards (per cent score)					Total Decline	
	3	5	7	9	(—)	Absolute	Relative
	5	10	15	20	(25)	(per cent score)	(per cent)
"Normal"	90	81	68	62	(56)	28	31
H-n	85	85	80	60	(—)	25	29
D-n	30	37	27	20	(—)	17	57
McG	33	27	7	0	(—)	33	100
E-n	33	53	34	22	(—)	31	58

average scores for normal subjects and the scores for the defective in experiments with figures. In general average the scores of H-n are on a par with the normal, those of E-n are considerably lower, those of D-n are next, and those of McG the lowest. The scores of H-n show slightly less decline than the normal, those of McG show the greatest decline. The least absolute decline is found for D-n, the relative decline for whom, however, is considerably in excess of the normal. For E-n the relative decline is about the same as for D-n.

Comparing these results with those obtained in experiments with pictures (Table XXXII) we find that with all but one subject the former are much inferior to the latter. With E-n the average "figure" score is but slightly inferior to the average "picture" score, but this inferiority arises from the results with 9-card sets. For 3-card sets the results are the same with both materials, and the "figure" score is superior to the "picture" score with 5- and 7-card sets. The various scores show a considerably greater total decline in experiments with figures than in experiments with pictures.

In the defective subjects the span of memory is thus decidedly greater for pictures than for figures in all but one case in which with a limited number of items the opposite is true.

In his experiments on normal subjects with advertisements for visual stimulation Strong found a steady decrease in the proportion of advertisements that could be recognized as the series increased.[3] This is found both with pictures and with figures in our experiments with normal subjects. What has been said in the foregoing indicates a more irregular influence of this factor in experiments with defective subjects, and especially with those whose memory defect is considerable.

3. Retention

The differences between the scores for delayed and for immediate recognition in experiments with pictures and variation in time of exposure with normal and with defective subjects are shown in Table XXXIV. H-n shows less difference than is found

Table XXXIV

Experiments with Figures and Variation in Time of Exposure

Differences between Delayed and Immediate Recognition

	Time of Exposure (per cent score)					Average Difference	
	1″	1/5″	1/10″	1/25″	1/50″	Absolute (per cent score)	Relative (per cent)
"Normal"	1	2	3	2	9	3.4	4.3
H-n	0	0	0	0	7	1.4	1.5
D-n	8	6	4	10	10	7.6	16.3
M-G	13	21	20	0	–1	10.6	25.7
E-n	1	10	19	—	—	6.0	28.8

for the average normal. It should be remembered, however, that with the normal subjects the retention time was increased from 3 to 5 minutes. E-n has the greatest average relative difference, with McG a close second. The average difference for D-n is considerably in excess of that for the normal. The difference for the normal and for H-n shows a tendency to increase with decreasing stimulation time. This tendency is clearly marked for E-n with exposures of 1″, 1/5″, and 1/10″, less clearly for D-n.

Table XXXV shows the differences between the scores for de-

[3] *The Effect of Length of Series upon Recognition Memory,* by Edward K. Strong, Jr. *Psychol. Rev.,* 1912, XIX, pp. 447 et seq.

Table XXXV

Experiments with Pictures and Variation in Number of Cards

Differences between Delayed and Immediate Recognition

	Number of Cards (per cent score)					Average Difference	
	3	5	7	9	(—)	Absolute	Relative
	5	10	15	20	(25)	(per cent score)	(per cent)
"Normal"	0	2	4	10	(16)	4.0	4.2
H-n	0	0	17	10	(—)	6.8	6.9
D-n	0	6	36	32	(—)	18.5	30.1
McG	34	32	28	36	(—)	32.5	56.5
E-n	33	18	28	33	(—)	28.0	77.2

layed and for immediate recognition in experiments with pictures and variation in number of cards. The average difference for H-n is slightly greater than the average normal, but not in excess of that for C-h among the normal subjects. For the other defective subjects the average difference is far in excess of the average normal. A tendency of the difference to increase with an increasing number of cards is more clearly marked in the normal than in the other results. With H-n and D-n the difference is greatest for the 15-card set, it decreases for the 20-card set. With the remaining subjects it is more irregularly distributed, with a high figure for the 3-card set.

Table XXXVI shows the differences between the scores for

Table XXXVI

Experiments with Figures and Variation in Time of Exposure

Differences between Delayed and Immediate Recognition

	Time of Exposure (per cent score)					Average Difference	
						Absolute	Relative
	1″	1/5″	1/10″	1/25″	1/50″	(per cent score)	(per cent)
"Normal"	10	6	6	10	10	8.4	14.0
H-n	15	8	8	5	10	9.9	10.9
D-n	17	17	19	10	35	19.6	66.7
McG	10	14	5	0	28	11.4	51.8
E-n	22	21	20	16	—	15.8	48.5

delayed and for immediate recognition in experiments with figures and variation in time of exposure. The average relative difference for H-n is smaller than that for the average normal, that for E-n is greatly in excess of the normal and that for McG slightly greater than that for E-n. D-n has the greatest average relative difference. The differences are unevenly distributed over the various exposures, with a tendency to increase with the long-

est and the shortest exposures. The difference for E-n decreases when the time of exposure is reduced.

Table XXXVII shows the differences between the scores for

TABLE XXXVII

Experiments with Figures and Variation in Number of Cards

Differences between Delayed and Immediate Recognition

	Number of Cards (per cent score)					Average Difference	
	3	5	7	9	(—)	Absolute	Relative
	5	10	15	20	(25)	(per cent score)	(per cent)
"Normal"	6	7	4	6	(4)	5.8	7.6
H-n	10	8	3	10	(—)	7.8	10.0
D-n	10	17	27	20	(—)	18.5	64.9
McG	0	14	14	0	(—)	7.0	41.8
E-n	0	21	5	5	(—)	7.8	21.8

delayed and for immediate recognition in experiments with figures and variation in number of cards. The average difference for H-n is greater than the average normal, the average relative difference for E-n is about twice that for H-n, that for McG about twice, and that for D-n about three times that for E-n. The distribution of the differences over the various sets of cards is irregular. In the case of McG it is confined to the two middle sets, in that of E-n it is concentrated on the normal set.

We reach the following conclusions: the retention interval reduces the results for recognition both with normal and with defective subjects; with normal subjects this reduction is greater with figures than with pictures; with pictures it increases with the number in the series, with figures no such increase is apparent; with pictures it also increases with a reduction in time of exposure; with figures there is less difference for exposures of 1/5″ and 1/10″ than for longer and for shorter exposures.

With *H-n* the influence of the retention interval in experiments with pictures is less marked than in the average normal results when the "normal" set is used. In experiments with figures the sum of the differences for the 10-card and the 15-card sets is the same with H-n as in the average normal results. In experiments with pictures as well as with figures the sum of the differences for the 15-card and the 20-card sets is greater with H-n than in the average normal results. Reduction in time of exposure has

less detrimental effect on retention with H-n than with the average normal in experiments with pictures, and about the same effect with both in experiments with figures. Thus the power of retention of H-n is not inferior to the average normal with smaller sets of cards, but an increase of the number in the series has a more detrimental effect on the power of retention of H-n than on that of the average normal.

With the remaining subjects the retention interval reduces the results in recognition in various degrees, both with pictures and with figures.

D-n. The respective relations between her average relative differences and those in the normal results are:

Pictures	and	variation	in time of exp.	.264
"	"	"	" no. of cards	.140
Figures	"	"	" time of exp.	.210
"	"	"	" no. of cards	.117

The influence of the retention time factor is relatively greater with figures than with pictures, and there is a further reduction with an increase of the number in the series.

McG. The respective relations between his average relative differences and those in the normal results are:

Pictures	and	variation	in time of exp.	.167
"	"	"	" no. of cards	.074
Figures	"	"	" time of exp.	.270
"	"	"	" no. of cards	.182

The influence of the retention time factor is relatively greater with pictures than with figures. With pictures there is a further decrease when there is a shortening in the time of exposure; with figures the opposite tendency obtains. There is little change in this influence consequent upon an increase of the number in the series with pictures; with figures no influence is noticeable with series of 3 and 9 cards.

E-n. The respective relations between his average relative differences and those in the normal results are:

Pictures	and	variation	in time of exp.	.150
"	"	"	" no. of cards	.054
Figures	"	"	" time of exp.	.289
"	"	"	" no. of cards	.349

The influence of the retention time factor is relatively greater

with pictures than with figures. With pictures it increases, with figures it decreases when the time of exposure is reduced. With pictures it increases with an increase of the number in the series; with figures it is greater in series of 5 cards than in longer series, and it is absent in series of 3 cards.

Differences in purpose and method exclude a direct comparison between the results obtained by Moore and those of the present investigation.[4]

4. Recognition and Recall

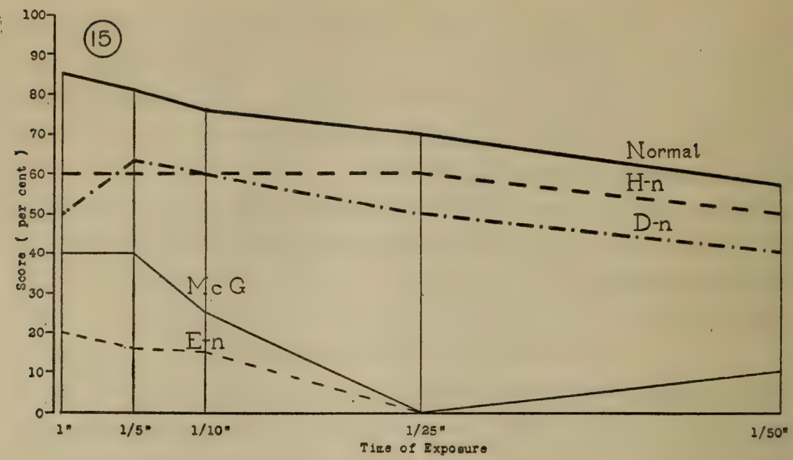
The relative differences between recognition and recall in the average scores for normal subjects in experiments with five variations in time of exposure may be expressed as follows, counting from 1″ to 1/50″ exposure: 11, 15, 15, —10, —14 per cent.[5] In other words, the recognition scores are superior to the recall scores for 1″ to 1/10″ exposures, and the reverse is true for shorter exposures. This relation does not obtain in all the individual scores. With all the normal subjects, however, the recognition scores are superior to the recall scores for 1″ and 1/5″ exposures (see Table I). In experiments with variation in number of cards the corresponding relative differences for the average normal scores are, counting from sets of 5 to sets of 20 (25) cards: 0, 6, 9, 21, (24 per cent). Hence, the results in recall become increasingly inferior to those in recognition as the number in the series increases.

The average normal recall scores and the recall scores for the defective subjects are shown in Figures 15 and 16.

H-n. While H-n has very high recognition scores his recall scores are considerably below the average normal recall scores, and also inferior to any of the individual normal recall scores. His recall score remains constant for exposures from 1″ to 1/25″ and declines for exposure of 1/50″. The following relative differences between recognition and recall appear in experi-

[4] *Op. cit.*

[5] These figures express the difference between the two scores in percentage of the highest. The positive values indicate that the recognition score is highest, negative that the recall score is highest.



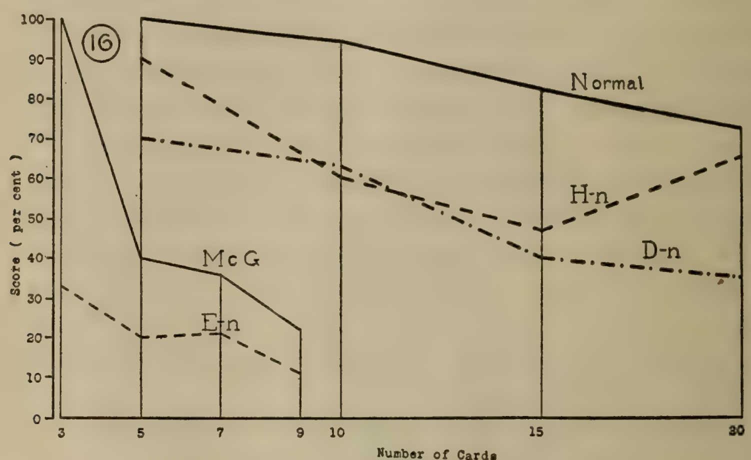


FIG. 15.—Variation in Time of Exposure. Per cent scores.
FIG. 16.—Variation in Number of Cards. Per cent scores.

Both figures show the average results for normal subjects and the results for the defective subjects in Recall.

ments with variation in time of exposure: 37, 40, 35, 33, and 43 per cent. In experiments with variation in number of cards the corresponding differences are, counted from sets of 5 to sets of 20 cards: 10, 40, 53, and 28 per cent. His recall memory is therefore inferior to the normal; it is not greatly affected by a reduction in time of exposure, but the proportion of items re-

called decreases rapidly with an increase of the number in the series.

D-n. In experiments with variation in time of exposure the relative differences between the scores for recognition and for recall are 26, 0, —5, —40, and —63 per cent, respectively. In experiments with variation in number of cards they are, respectively: —14, 0, 21, and 42 per cent. Her recall scores are considerably lower than the average normal, but they show little decline when the time of exposure is reduced. The relation between her recall and her recognition scores is, generally speaking, similar to that for the average normal, with the exception that in her case the differences for both the longest and the shortest exposures are greater than in the case of the average normal. Her recall memory is superior to the recognition memory for sets of 5 cards, equal to the recognition memory for sets of 10 cards, and inferior for larger sets. This inferiority increases at a proportionately higher rate than with normal subjects as the number in the series is increased.

McG. In experiments with variation in time of exposure the relative differences between the scores for recognition and for recall are, respectively: 45, 26, 53, 100, and —40 per cent. In experiments with variation in number of cards they are for sets of 3, 5, 7, and 9 cards, respectively: —33, 41, 31, and 50 per cent. His recall scores fall greatly below the average normal and decrease both with a reduction in the time of exposure and with an increase in the number in the series. In their relation to the recognition scores they are proportionately inferior to the normal recall scores, except for the 3-card set for which the score is perfect.

E-n. In experiments with variation in time of exposure the relative differences between the scores for recognition and for recall are 35, 57, and 57 per cent, respectively. In experiments with variation in number of cards they are, respectively: 0, 57, 36, and 67 per cent. His recall scores are very low, declining both with a reduction in the time of exposure and with an increase in the number in the series. With exception of that for the 3-

card set they are inferior to the normal in their relation to the recognition scores.

Dr. Achilles experimented with subjects afflicted with the Korsakow psychosis, general paralysis, brain syphilis, and arteriosclerosis, using four kinds of material, viz., words, forms, proverbs, and syllables, which were presented in separate series of 25 items, each presentation lasting 50 seconds. Experiments were made both for recognition and for recall. In addition, a series of 6 pictures was presented for recognition only. The experimenter remarks that "the data of all the cases are not comparable, for the conditions of the experiment were not the same for each patient. Some of the patients were unable to see well, and for them it was necessary to . . . present the material auditorily. When it was possible . . . the materials were . . . presented visually." She concludes that "all show a memory defect and the defect is present in both recall and recognition," and that "one finds the scores among the Korsakoffs lower than those among the general paralysis and arterio-sclerosis cases. There is no striking difference between the way the diseases affect the recall and recognition."[6] The tabulated results[7] show that the relation between recall and recognition varies greatly with different subjects, and with different materials for the same subject.

5. Primacy and Regency

Table XXXVIII shows the distribution of selections with the "normal" set of cards for the four defective subjects. It is compiled from Tables XXVI-XXIX. Tables XXVIII and XXIX have been reduced by combining the figures for the first and second, third and fourth items exposed, etc., and similarly the figures for the first and second, third and fourth selections, etc.

On an average, the last and the next last items exposed are most frequently, and the third item least frequently selected in immediate recognition of pictures; with figures the last item is

[6] *Op. cit.*, p. 64.
[7] *Ibid.*, p. 65.

TABLE XXXVIII

Summary of Distribution of Selections

Figures give per cent selections of total number exposed

1. *Pictures*

Order of Exposure	Mc-G Rg	Mc-G Rt	E-n Rg	E-n Rt	H-n Rg	H-n Rt	D-n Rg	D-n Rt	Average Rg	Average Rt
1st (1st & 2d)	53	53	63	43	85	93	83	81	71	68
2d (3d & 4th)	67	63	63	43	87	82	67	75	71	66
3d (5th & 6th)	57	70	60	50	89	89	72	83	70	73
4th (7th & 8th)	83	63	53	53	89	82	69	58	74	64
5th (9th & 10th)	87	67	80	53	87	82	81	56	85	65
Average	69	63	64	48	88	86	74	71	74	67
Av. diff. Rg & Rt	6		15		2		3		7	
Diff. from Av.	—5	—4	—10	—19	+14	+19	±0	+4		

2. *Figures*

Order of Exposure	Mc-G Rg	Mc-G Rt	E-n Rg	E-n Rt	H-n Rg	H-n Rt	D-n Rg	D-n Rt	Average Rg	Average Rt
1st (1st & 2d)	38	58	73	58	77	77	62	42	63	59
2d (3d & 4th)	54	54	58	62	100	88	69	73	70	69
3d (5th & 6th)	73	54	62	54	88	92	58	62	70	66
4th (7th & 8th)	46	58	62	58	96	88	62	50	67	64
5th (9th & 10th)	92	54	85	58	92	85	46	35	79	58
Average	61	56	68	58	91	86	60	53	70	63
Av. diff. Rg & Rt	5		10		5		7		7	
Diff. from Av.	—9	—7	—2	—5	+21	+23	—10	—10		

most frequently, and the first item least frequently selected in immediate recognition. In delayed recognition the third item is most frequently, and the fourth item least frequently selected with pictures; with figures the second item is most frequently, and the last item least frequently selected. Thus recency has a marked effect on immediate recognition with both materials. Individual results have already been described in Section V.

6. CONCLUSIONS

1. Although the defective subjects who were tested showed a memory defect which appeared essentially the same when clinically considered, the experiments show that the memory defect varies in these subjects. The amnesia in the subjects under investigation is due both to faulty apprehension and to faulty retention. Both recognition and recall are affected. The defect is

present with pictures, which may be described in verbal terms, and also with figures, in which a verbal description is impossible (or at least improbable). The memory for pictures is usually better than that for figures.

2. Apprehension and retention abilities are affected to varying degrees in the four subjects. The recall memory is also seriously affected. One subject showed an impairment in recognition only for a great number of items to be remembered simultaneously. Although the memory for pictures (visual-kinaesthetic-auditory) is usually better than that for figures (purely (?) visual), in one case the reverse was found.

3. The defective subjects investigated showed, in general, the same effects as normal subjects in apprehension and memory following brief or longer exposures, and the beneficial effects of primacy, recency, and repetition.

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7

A Study of the Moral Development of Children

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INTRODUCTION

The original idea in the piece of research here presented, was merely to standardize a series of Moral Information Tests as perhaps a useful aid in the study of delinquent children. Such a series of tests, it was felt, would enable the examiner to find out whether or not the delinquency was due to lack of moral training. It was thought desirable that the study be made on public school children as their moral development may be assumed to be more free, in general, than that of the individual who has been influenced by what may be looked upon as the artificial stimulus of religious education. If the natural cause of the development of morality comes from the friction of the individual with his environment,[1] then native moral concepts would probably be obscured in children who from earliest childhood received definite and constant moral instruction. About two hundred preliminary tests were given in the public schools of a small town in western Pennsylvania; about seven hundred revised tests were given in a small city of the same vicinity; and about one thousand revised tests in the schools of a large industrial center. All the papers were not delivered from the school system mentioned last, and consequently the study was completed in the parochial schools. Two thousand cases were taken from parochial schools of a large industrial center in the Middle West at the beginning of the fall term, 1921. All the other tests, including two hundred individual tests from parochial schools of eastern cities, were given the spring previous. The consideration of parochial school cases will not be without its advantages, however, in as much as it gives us some basis of comparison between children whose moral education is merely that of the home and their environment, and those whose moral education is affected by deliberate and daily attempts to engraft moral and religious ideas in the school.

The standardization of the tests led to an attempt to schematize

[1] Moore, T. V., "A Historical Introduction to Ethics," 1915, p. 150.

the moral development of children. This is, perhaps, of more value than the mere standardization itself. The study affords, we think, a very good insight into the moral development of the child and gives us a fairly well standardized set of Moral Information Tests which will allow a study of the delinquent child from a point of view which is different from the intellectual standpoint of the Binet-Simon and other similar tests.

CHAPTER I

Statement of the Problem

The subject of this paper was suggested by the clinical problem of the so-called "moral imbecile." Delinquent children and adults appear before the psychiatrist. How are they to be diagnosed? A physical examination may prove them normal. An intelligence test may show an average intellectual quotient or even supernormal mental ability. A social worker may report the home environment as good. The problem seems to be in such cases definitely one of a moral deficiency. But the diagnostician has no means of measuring the kind or extent of this deficiency. The tests as originally worked out were meant to meet this need, if possible, by standardizing, after the order of the intelligence tests, a test of moral knowledge. Tests were devised covering the general moral problems of our social life, and were to be given to a sufficiently large number of children, preferably from the public schools, to make the results general. As the work progressed a second problem, of greater educational value, suggested itself. It was to find, by means of tests, at what age the child is most keenly alive to certain virtues or faults, as, e.g., jealousy, sympathy, theft, etc. Such information would be invaluable as the basis of a course in moral instruction, so widely heralded and so badly needed. With these two problems in view, then, the tests were given to approximately four thousand school children. The data presented in the following pages represents the extent to which these children revealed their moral knowledge through the questionnaire.

CHAPTER II

History of the Problem

A list of articles and books written on Morality, Moral Education, and related topics and treating the subject theoretically, would probably show a bibliography greater than that of most subjects. And yet very little of an empirical nature has been written on the subject of Moral Education or Moral Development.

In many cases works claiming to be non-theoretical are based upon the author's general experience in a school room, or upon close observation of a few cases with no particular end in view and with no definite method of procedure. Such works are either too inexact or too limited in the number of cases to be considered as empirical studies. This criticism applies even to so excellent a work on child study as that of Compayre.[1, 2]

In some intelligence and school tests, questions having moral significance are inserted; but these questions are treated as intellectual rather than moral. The ignoring of the moral element renders the answer worthless for our purpose. This is true in the Stanford Revision of the Binet-Simon Intelligence Tests, Year VIII, Question 3c: "What's the thing for you to do if a playmate hits you without meaning to do it?"; or, Year VIII, Question 3a: "What's the thing for you to do when you have broken something which belongs to someone else?"

Edward Westermarck, in his "Origin and Development of Moral Ideas," traces the growth of the great social virtues and crimes as revealed in all degrees of civilization ranging from barbaric tribes to civilized nations. He cites, in proof of the ex-

[1] Compayre, Gabriel, "Development of the Child in Later Infancy," 1914.

[2] Other works of this type are: Cabot, Mrs. Ella, "Ethics for children," 1910. Coler, C. S., "Character Building," 1899. Ellis, Florence H., "Character Forming in School," 1907.

istence or non-existence of a virtue now recognized, tribal laws and customs. The work is of interest as a comparative study of race development and child growth. Its chief value, however, is philosophical rather than empirical.

Very valuable information on the moral ideas of delinquent children and their origin has been published in the works of William Healy.[3] Dr. Healy, from his vast experience and from the numerous court records at his command, has been able to offer much generalized data and to suggest remedies for moral deficiencies. His works are concerned, however, with single, frequently committed faults. They do not, therefore, form a study of the basis of morality in children; and as the viewpoint is that of the reformation of the delinquent, they are not of primary aid in the work of moral education.

Judge Lindsey, in an interesting paper read before the National Education Association,[4] classifies the most common offences against morality among school children as follows: disobedience, swearing, use of tobacco, lying, stealing, and personal impurity in thought and action. He points out, further, the false attitude of children toward the court and its punishment. It is rarely the case that a delinquent is aware of the necessity and the justifiability of court action. An act is wrong, he thinks, because he has been caught; the fault is not in the doing, but in being caught at it. This article of Judge Lindsey's suggests several things to be looked for in normal children in a study such as is now being reviewed.

William Whitney, in his "Moral Education," reports a study made of 600 boys and 600 girls ranging from the first through the eighth grade. The object, he says, was "to ascertain the relation, if any, between 1. Religious training and deportment; 2. Home training and deportment; 3. Effect of deportment upon scholarship."[5] He investigated the following factors of deportment: truthfulness, honesty, industry, perseverance, serviceableness, re-

[3] Healy, William A., "Honesty," 1915. *Ibid.;* "Pathological Lying, etc.," 1915.

[4] Lindsey, Ben B., "Childhood and Morality," In National Educational Association, Proceedings for 1909, p. 149.

[5] Whitney, William T., "Moral Education," 1915, p. 10.

spect for authority, respect for rights of others, and for property, cleanliness, economy, promptness, and obedience. He draws in general this conclusion: "Where religious instruction is neglected and where the home training is given scarcely any consideration, the boys and girls suffer proportionally."[6] This study offers a strong argument for direct instruction in morals in the schools as the best means of forming habits of virtue. The study is one of the effect of environment on the morality of children. It does not consider anything beyond the morality of the child as deduced from his actions by an adult mind. It gives the child no opportunity to reveal his knowledge or his motives—both of which are very important in getting at the basis of child morality.

A series of experiments carried out in the city of Glasgow in 1911 tend to emphasize the importance of moral training to the child. The results of these experiments go to prove that children of bad parentage, if removed from vicious surroundings and carefully trained, can be made into upright citizens, with only a small percentage of failure.[7] Such a study proves conclusively the value of moral training and the necessity for experimental study of the moral ideas of children.

J. R. Street in an article entitled "A Study in Moral Education" reports the results obtained from a syllabus issued by Dr. G. Stanley Hall. This syllabus was sent out "with a view to approaching the question from the side of introspection and thereby discovering a psychological basis for the investigation of the laws that underlie the higher development of the moral nature."[8] The individuals answering the syllabus were asked to describe the nature and effect of punishments received as children; a case of self-denial; a conscience case; the effect of direct moral and direct religious instruction on their development; the influence of teachers, companions, and adults; the influence of games and reading;

[6] Whitney, William T., "Moral Education," p. 16.

[7] Barnes, Clifford W., "Status of moral training in the public schools." In National Education Association Proceedings for 1911, p. 411.

[8] Street, J. R., "A Study in Moral Education." Pedagogical Seminary, 1898. p. 5.

their ethical relations with their parents; their favorite books; and the proverbs they liked best. From the replies on punishments the author points out that punishment to be effective should be retributive, and not vindictive. "The child's disposition," he says, "should be the determining factor and, as far as possible, the punishment should follow as a natural consequence (cause and effect) of the misdeed."[9] Conscience, from the reports received from this study, does not play any great part in life before the age of nine, and very little mention is made of it before thirteen. This is contrary, he points out, to the generally accepted belief.[10] However, Mr. Street calls attention to the fact that his cases are too few to admit of generalized conclusions. The maxim "Sound knowledge of moral truths is good, but sound habits of moral action are better"[11] is drawn in conclusion.

This article is an excellent suggestion as to the possibilities of experimental study along moral lines. Of itself, however, it is not exhaustive enough to be really valuable. It can be criticized, also, it seems, in using introspection on memories that perhaps reach many years. Under such conditions only a rare subject could give exact information.

F. W. Osborne, in "The Ethical Contents of Children's Minds" asked a group of school children of above average social and intellectual standing, "What must a boy do to be called a good boy?" and "What must he do to be called a bad boy?"[12] He found out that the two virtues most frequently mentioned as essential to a good boy or good girl are obedience and truthfulness, the former being more important than the latter. His results confirmed what has been frequently noticed, namely, that to young children right is what is permitted and wrong is what is forbidden. This work, while not very exhaustive as to the number of cases used, or the number of ethical ideas investigated, is interesting and valuable as a preliminary study in moral development.

[9] Street, J. R., "A Study in Moral Education." Pedagogical Seminary, p. 6.
[10] *Ibid.*, p. 7.
[11] *Ibid.*, p. 40.
[12] Osborne, F. W., "The Ethical Contents of Children's Minds," *Educational Review*, 1894, p. 143.

A study in juvenile ethics made by L. W. Kline approaches the problem in a manner somewhat different from that of Osborne. His questionnaires were sent to public school children of both city and country districts and the ideals of the two groups were compared. His test consisted of two stories on which the children were asked questions which would reveal their moral ideals, and one of which they were asked to finish themselves. Finally, they were asked to write what they wish to be or do when they grow up.

In general Mr. Kline draws the following conclusions: Children from eight to eighteen are, as a rule, altruistic rather than selfish, country children more so than city children. He calls particular attention to the fact that "the higher percentages of altruism are not confined to adolescent years."[13] He notes that judgments of right and wrong in children from eight to eighteen are more likely to issue from emotional than from intellectual processes. The two exceptions to this rule were (1) the economic principle of barter and trade and, (2) the semi-sentimental principle that a gift cannot be taken back. Boys, he found, were more original than girls, and country children more than city children. The results of this study may serve as a basis of comparison in many points for the tests we are now considering.

In a work entitled "The Psychology of Child Development" a study is made of children's aspirations. The author points out that we must always judge the child from the standpoint of his undeveloped sense of adult values.[14] He notes that adolescence is a time of marked susceptibility to the influence of others, an indication of the coming consciousness of social relationships. The age of twelve was found most susceptible to evil influence—"an evidence of the beginning of the imperious attitude toward restraint that is so prominent in the next few years."[15]

The child, and even the youth, Mr. King says, can only come

[13] Kline, L. W., "A study in Juvenile Ethics." Pedagogical Seminary, 1903. p. 246.

[14] King, Irving, "The Psychology of Child Development," 1903, p. 144.

[15] *Ibid.*, p. 193.

to a comprehension of the meaning of the complex system of values recognized by society by meeting crises for himself and readjusting his direct and unreflective action to ever broader settings. The presence of a sense of moral values implies a concomitant experience of great maturity and complexity. Unfortunately this means of readjusting themselves is denied to some children because of the atmosphere adults throw around them, and consequently there is no moral growth. They are met at every turn by a "Do" or "Do not do this," and they either blindly obey or rebel. They cannot develop morally, because the right to decide, the sublime condition of all moral development, has never been theirs.

In general, the results of Mr. King's study may be summed up as follows: (1) Boys' moral ideals at ten are negative rather than positive, i.e., the fragments of adult morality they have imbibed are of this sort. They wish, for instance, to avoid bad habits. (2) Girls express as their highest desire that of being good to others. (3) Altruistic feelings definitely appear at twelve and are at first directed toward parents. (4) At fourteen, various social virtues are recognized as necessary for success in business.

It has been stated that as Pestolozzi and Froebel discovered childhood, so Dr. G. Stanley Hall has discovered youth. Dr. Hall's works are recognized at home and abroad as authoritative pieces of research in child study. In his "Educational Problems" he has an interesting and inspiring chapter on "Moral Education" which, however, treats the problem from a philosophical rather than from an experimental viewpoint. He remarks in this work that "every moral fault in every child also means that someone has lacked and needed education."[16] How quickly our plea for moral education would be realized if educators were fully cognizant of this responsibility!

In his classical study "Adolescence,"[17] Dr. Hall summarizes without exact data, material on moral investigations which were published in detail previously, either by him, personally, or by

[16] Hall, G. Stanley, "Educational Problems," 1911, p. 291.
[17] Hall, G. Stanley, "Adolescence," 1907.

some of his students. Among other articles thus summarized is an interesting study of "Children's Lies" originally published by Dr. Hall in 1891.[18] In speaking of the purpose and method of the study he says "a number of accomplished and tactful lady teachers . . . have undertaken, as a first step towards getting a fresh and independent view of the facts of the situation, to question and observe individual children, by a predetermined system as to their ideals and practices and to those of their mates in this regard."[19] About three hundred children were thus studied and the results given in general statements rather than in tabular form.

Results of this study show that children hold truth for our friends and lies for our enemies as a practical, although not distinctly conscious, rule. Lies are justified in the minds of children as a means to a noble end. With girls a question of personal interest is how far etiquette may stretch truth to avoid rudeness or hurting another's feelings. In answering a friend's question as to whether some thing or act they did not particularly admire, was not very nice or pretty, they found it hard to say "No," and compromised on "Kind of nice." Girls were more addicted to this than boys. Thus, with truth as with cheating, most children are greatly affected by personal likes and dislikes.

This completes the list of empirical studies found to have any bearing on the problem as considered in this work. Some of these studies have suggested general fields of research similar to that we are now reviewing; others have touched on one or another particular phase of this problem, but, on the whole, it may be said that, considering the importance of Moral Education to the individual, to society, and to the nation, it has been given a very minor place in educational research.

[18] "Children's Lies." *American Journal of Psychology,* III.
[19] *Ibid.,* p. 59.

CHAPTER III

The Tests and the Technique of Administering Them

The "Tests for Measurement of Moral Knowledge" fall into three groups, each of which brings into play a different method by which the moral concepts of the child may be drawn out. They are briefly, a series of questions and exercises, a group of pictures, and a number of little stories. In compiling these three groups the attempt was made to touch upon the most vital and the most concrete problems that the average child is called upon to meet. The tests as first presented to about two hundred children differed materially from the revised forms. The results from both forms will be given. Those originally employed were taken from literary rather than from practical sources. Such works as "The Baltimore Catechism," "A Child's Bible History," "Sunday School Lessons," Sunday School magazines, and school readers offered the chief suggestions in the composition of the tests. As was expected, the preliminary tests revealed in their results, much that was not pertinent. All questions which were doctrinal rather than moral in content were ruled out. Numerous new and valuable ideas were suggested by the children's answers, and these were incorporated into the revised tests. Besides eliminating much of the old and introducing much that was new, the form of the questions was in many cases changed. As we proceed with the explanation and discussion of the tests, such changes will be pointed out.

The tests were given both as individual and as group tests. The original idea was to make the study solely from group tests, but this was found impracticable with children below the fifth grade because of their inability to express themselves in writing. From the fifth grade through the high school the tests were given to groups varying in size from fifteen to two hundred. All the group tests were given by the author and one assistant to insure

uniformity of method and of instructions. The individual tests were given by the author aided by two assistants both of whom were graduate students in Psychology and carefully instructed in the technique of administration.

The preliminary tests were mimeographed; but when revised, they were printed in booklets of about the same size as the Stanford Revision Booklet. Because the whole test was too long to be taken at one sitting without fatigue, it was divided into two parts, each part consisting of an eight page booklet. To complete each booklet a child needed approximately one hour.

Part I consists of sixteen moral stories and eight pictures. Part II consists of a series of questions, some exercises, and a vocabulary test of fifty words. Whenever it could be conveniently carried out, Part I was presented first because it was thought to be more interesting. However, from observation, it may be stated that most of the children seemed to enjoy the mental exertion required to answer the questions in Part II as much, if not more, than the stories. The general reaction to the tests on the part of the pupils was much better than one would be led to expect in questions of this nature. The pupils with few exceptions were interested and what is more important, were serious about the task set before them.

The brief instructions used in administering the group tests and the more detailed ones used in the individual tests are given in Chapter X. The children were asked to fill out the face sheet in full. Because it was thought that names might interfere with the frankness of the children in answering the questions, a numbering system was used. This proved so cumbersome in the public schools, however, that it was discarded when the tests were given in the Catholic schools. It was found an advantage even in the high school to go over every detail on the face sheet with the class—uniformity was thus insured and much time saved. The form of the face sheet is given below.

Wherever it was possible, the teacher was asked to check the "school success" of the child after he had written the paper. The "moral status" which was designed to be that of the individual

MEASUREMENT TEST

Name..............................Boy, Girl, Date....................
School ....
City ....State ....
Grade ....Age, Years .... Months..........
Date of Birth..
Years attending school........Grades repeated........Grades skipped......
School success: very inferior, inferior, average, superior, very superior
Moral status: poor, average, good
School status: poor, average, good
Remarks on the examination
Miscellaneous remarks

was not checked—very few teachers knew enough about the children to be able to grade them on the basis of their general morality. The "school status" which refers to the social status of each school tested, was recorded. No use has been made of the data thus obtained. All the children tested were whites; in grades where one or more colored children were present the teacher was requested to destroy their papers. This was done in all cases.

In our explanation we shall first consider Part II of the Test which is divided into eight chief headings. Each of these groups involves a different kind of problem and each problem is presented in a different way.

Group I reads:

I. *Is it a sin, (Answer "yes" or "no".)*

1 *to stay away from church on Sunday?*........................
2 *to go to bed without saying your prayers?*........................
3 *not to say "grace" before meals?*........................
4 *to talk about someone you do not like?*........................
5 *to talk in school?*........................
6 *to throw snowballs?*........................
7 *to throw snowballs when forbidden to do so?*........................
8 *to tell or listen to a bad joke or story?*........................
9 *to look at pictures that are not nice?*........................
10 *to keep the change if the clerk gives you too much?*........................
11 *to fight?*..............
12 *to cheat?*................
13 *to flirt?*..............

Group I asks, *Is it a sin* to do those things which are enumerated above. The answer is to be in the form "Yes" or "No." The

word "sin" is used in this question because it is more concrete to the mind of a child than "wrong." The test as above presented differs from the preliminary test in that questions No. 6 and 7 were there combined in the form *To throw snowballs* (*when forbidden to do so*)? Question No. 12 was inserted here when the group in which it was placed originally was discarded. This original group asked, *Why is it a sin* to do certain things. It was found to be too difficult for most of the children and practically impossible to score. Question No. 13, *to flirt,* appears for the first time in the revised form of tests.

It might be expected that the answers of the children would vary greatly in this group of questions depending on their religious belief and environment. Something will be said with respect to such variations later.

Group II asks, *What should you do* in certain situations which are fairly typical of child life.

II. *What should you do*

1 *if you saw a lady in front of you drop a five-dollar bill?*............

2 *if your playmate broke your checker board?*.......................

How should you act

3 *if your teacher scolded you for not having your lessons?*.............

4 *if your mother told you to come home to go to the store, and the boys wanted you to play ball?*.....................................

5 *if you had a bag of pop-corn and were eating it when a little child looked up at you hungrily?*...................................

As first given this test included two questions which we have not thought advisable to incorporate in the revised form. The question *What should you do if you saw a little boy trying hard to get his wagon which is filled with groceries, up over the curb?,* was considered too simple to be repeated in the revised test; while the question *If you were sucking a lolly-pop and saw a little child looking up at you hungrily, what should you do?* involved the same principle as question No. 5. The chief difference in the answers was not one of principle, but merely the fact that most of the girls solved the "lolly-pop" difficulty by saying "I would buy him one." The question of hygiene may possibly be considered in this answer, but it was not of sufficient importance to warrant our keeping the question.

Group III consists of a series of questions which require considerable introspection on the part of the subject. The first six questions underwent no change in the revised form of the tests. They concern the child's knowledge of his obligation to the Deity, of his relationship to his parents, and of his destiny.

III.

1 *What would you think if you heard a boy say "There is no God."?.....*
2 *What happens to a good little boy when he dies?.....................*
3 *Whom do you love best in all the world?............................*
Why? ....
4 *Why were you made?...*
5 *Who made you?...*
6 *From where do you think you came?..............................*
7 *Name three things it is wrong to do.*
(1) .... (2) .... (3) ....
8 *Name three things it is good to do.*
(1) .... (2) .... (3) ....
9 *Write down the following list of faults in the order in which you think you commit them most frequently.*
Selfishness, lying, cheating, stubborness, stealing, swearing, disobedience, insolence.
10 *What one action do you consider the best a person can do during life?..*
11 *What one action do you consider the worst that a person can do during life? ....*

Questions No. 7 to 11 in this Group were not given in any form in the preliminary test. No. 9 was suggested by having a number of school teachers observe their children for a period of four weeks, recording the faults they committed during that period and the frequency of their occurrence. The eight faults given in this question are the result of the observation. A correlation between these faults as the children see them and as they are seen by the teachers is most interesting.[1]

Questions No. 7 and 8 show by the order of their frequency what faults and virtues are most emphasized in the life of the child. These questions are closely related to questions No. 10 and 11 which ask for the "worst" and "best" action a person can do during life.

Question No. 11 may in many cases bring a sexual response, which was the chief reason for its being placed in this Group.

All the questions in Group IV were given in exactly the same

[1] See p. 158.

form in the preliminary test. The first three questions concern the wrongfulness of an act in the abstract,—that is when conscience alone is the accuser. All the questions present situations and ask the child what should be done. These questions differ from those of Group II only in the fact that they are a little more difficult. Question No. 6 is taken in its general form although not verbatim, from the Stanford Revision of the Binet-Simon Tests, Year VIII, Question 3c.

IV.

1 *Would it be wrong to say a swear-word when no one is around?......*
2 *Would it be wrong to take a nickel out of your mother's pocket-book without asking her?..*
3 *Would a lie be a lie if no one ever found out you told it?............*
What should you do
4 *if a little boy or girl who never said any night prayers came to stay at your house for two or three nights, and got into bed before you have said your prayers?..*
5 *if your mother scolded you very hard?............................*
6 *if a playmate hits you without meaning to do so?..................*
7 *if your ball went through a neighbor's window?......................*
8 *if while playing in the parlor you broke one of your mother's best chairs? (No one saw you break it, and your brother was blamed for doing it.)* ....

Group No. V which was used for the first time in the revised test consists of four columns of words, all of which designate some moral trait, whether good or bad.

The subject is asked to draw a line under each word in the list which indicates a trait of character he would like to possess.

V. *Draw a line under each word in the list below which indicates a trait of character you would like to possess.*

gloomy	*obedient*	*conceited*	*frank*
humble	*foolish*	*deceitful*	*flirt*
aggressive	*simple*	*lazy*	*patriotic*
careless	*thief*	*sincere*	*insulting*
loving	*polite*	*charitable*	*generous*
shrewd	*affected*	*vain*	*loyal*
dissipated	*neatness*	*liar*	*proud*
friendly	*insolent*	*extravagant*	*quarrelsome*
modest	*wicked*	*dishonest*	*patient*
immoral	*self-respecting*	*stubborn*	*cautious*
sullen	*pliable*	*peaceful*	*indecent*
cheerful	*impudent*	*sneak*	*honest*

There are twenty-one desirable traits if we include "simple." The number of these traits which the individual checks off should give some indication of his moral vocabulary at any particular age. This test is not definite enough to bring out any moral principles of children.

Group VI is of the same character as Group V but is much more definite in its nature. It was used also for the first time in the revised test. This test was suggested by one devised in the Department of Psychology of Indiana University.[2] When the test blank which suggested our test was received in the fall of 1920, the tests on it had not yet been given in the Indiana schools. This test as we have used it is much the same form as the Indiana test, but it is not so long nor does it use the same groups of words.

The test requires the subjects to cross out in each line that word which is worst. Each line contains one word which names an act that is conspicuously worse than any of the others named. Two examples are given at the beginning of the test, and the examiner has the class cross these out in his presence to be sure that they understand what is to be done.

VI. *In each of the following lines cross out the word that is worst.*

Example (1) *begging, lying, smoking, murder, cheating.*

Example (2) *dullness, foolishness, laziness, slowness, pity.*

1	*fighting*	*borrowing*	*charity*	*killing*	*dislike*
2	*dancing*	*flirting*	*obedience*	*adultery*	*smoking*
3	*holiness*	*cruelty*	*kindness*	*haste*	*slang*
4	*frankness*	*disloyalty*	*shrewdness*	*vanity*	*bigamy*
5	*rudeness*	*meekness*	*gossip*	*slander*	*hesitancy*
6	*bullying*	*insult*	*black-mail*	*tattling*	*scolding*
7	*flattery*	*lying*	*fibbing*	*frank*	*insincere*
8	*love*	*hate*	*fondness*	*dislike*	*liking*
9	*courtesy*	*pleasantness*	*friendliness*	*gentleness*	*timidity*
10	*stinginess*	*carfulness*	*generosity*	*charity*	*economy*

In a reprint of the blanks the word "adultery" in line 2 was changed to "idolatry." This was done in view of the unfavorable criticism which this test received from the principal of one school.

[2] Mental Survey Scales. Cross out Tests. Test IV, Moral Judgment Schedule. Indiana University, Department of Psychology.

The recognition of the worst word in each case indicates that the child has some knowledge of the moral problems suggested by the word in question. This test may be expected to show the way in which the moral perspective changes as the child grows older.

Little but the original idea remains in Group No. VII. The original test reads:

In what way are these things alike and in what way different:

Angel	*Jesus Christ*	*Disobedience*	*Stubbornness*
Devil	*Holy Ghost*	*Stealing*	*Cowardice*
Saint	*The earth*		*Love*
Sinner	*Heaven*		*Friendship*
		Swearing	
Priest (minister)	*Baptism*	*Praying*	*Happiness*
Doctor.	*Penance*		*Pleasure*

The test as revised took the following form:

VIII. *In what way are these things alike:*	*In what way are these things different:*
(a) *disobedience*	(a) *saint* ....
stealing	*sinner* ....
(b) *swearing*	(b) *God* ....
praying	*man* ....
(c) *angel*	(c) *lying* ....
baby	*cheating* ....
(d) *God*	(d) *love* ....
your soul	*hate* ....
	(e) *selfishness* ....
	gratitude ....

When likeness and difference were combined in the one question it was found to confuse the subject. Therefore, in the revised test the questions were separated. It was found, also, that the couplets *stubbornness and cowardice, love and friendship, happiness and pleasure,* were too abstract for any but an adult to detect a likeness or difference.

As was pointed out previously in a general way, such couplets as *Priest and Doctor, Jesus Christ and Holy Ghost, Baptism and Penance* of a purely religious nature, were left out. A comparison of the two forms of the test will reveal further the fact that the modifications have tended to simplify it considerably.

Group VIII consists of fifty words for which the subject is asked to give definitions. Only the words marked with the asterisk were taken over from the original to the revised vocabulary. The definitions obtained in that experiment enabled us to formulate a new list of words which were arranged in an order judged to be that of their increasing difficulty. It is found that with No. 46, *Sadism,* we reach an upper limit for even the adult mind. The purpose of inserting such words as *masochism* and *masturbation* in the test was originally that they would be known only to persons having the vocabulary of a particular science. However, so many questions were raised as to the advisability of presenting them, that the four words, *adultery, concupiscence, masochism and masturbation,* were omitted in the final form.

IX. *What does each of the following mean?*

*1 *God* ....
2 *bad* ....
*3 *sin* ....
4 *sad* ....
5 *lie* ....
*6 *hell* ....
*7 *love* ....
8 *flirt* ....
9 *obey* ....
10 *kind* ....
*11 *devil* ....
*12 *holy* ....
13 *pity* ....
14 *lust* ....
15 *hope* ....
*16 *soul* ....
17 *charity* ....
18 *abhor* ....
19 *gratitude* ....
20 *snob* ....
21 *cruel* ....
22 *steal* ....
23 *gentle* ....
24 *pride* ....
25 *mercy* ....
26 *death* ....
*27 *Satan* ....
28 *anger* ....
29 *virtue* ....
*30 *heaven* ....
31 *justice* ....
32 *courage* ....
33 *worship* ....
34 *adultery* ....
35 *obstinate* ....
36 *murder* ....
37 *counsel* ....
38 *patience* ....
39 *suicide* ....
40 *blasphemy* ....
41 *effeminate* ....
42 *infanticide* ....
43 *veneration* ....
44 *patricide* ....
45 *degradation* ....
46 *Sadism* ....
47 *concupiscence* .....
48 *masochism* ....
49 *masturbation* ......
50 *manslaughter* ......

CHAPTER IV

Interpretation of the Moral Problems presented by means of Stories

The division of the tests designated as "Moral Stories" consists of a number of basic moral principles incorporated into the form of short sketches or stories. The principles chosen are those which govern largely the individual's relation to society; and those, the right understanding of which is of vital importance to its welfare. By using story form the interest of the child is captivated and a thoughtful response is thus insured. This response will show two things of importance, (1) whether the child has had the experiences to form a background sufficient to enable him to interpret the problem and to use correctly the principles involved; and (2) whether the child has the ability to solve the moral problem involved. It is evident, of course, that an awareness of a moral principle may be present without the child's being able to suggest a satisfactory solution of the difficulty presented. This offers a twofold means of measuring the moral development of the child—the age at which he acquires knowledge, and the age at which this knowledge coupled with reason enables him to solve moral problems.

One great difficulty was encountered in these stories—this was the problem of getting knowledge on questions of sex. Any attempt to understand the morality of children, especially at the period of adolescence, while leaving out all consideration of sex, would be futile. The difficulty resolved itself into a consideration of whether stories could be presented that would give no information on sex to the child and yet would, by the type of answer given, show whether the child had any appreciation of sex questions. Stories No. 13 and 16 below are of this type. An answer showing an appreciation of a sexual situation, will also by its nature reveal the extent to which the subject is alive to such problems.

Many objections to these stories have been raised by those who have seen the tests. The basis of the chief objection is, it seems, the accusation that the author has overlooked entirely the power of suggestion when dealing with the adolescent mind. It was stated that the mere presentation of certain problems would be sufficient to make the adolescent think along these lines, which would be undesirable. The author feels assured that the problems contained in these stories are so veiled that they will give no information to the child. Therefore, unless some knowledge of the problem was present in the mind of the subject previous to the reading of the story, no interpretation of the story would be possible, and consequently it would have no suggestive value. If the child can interpret the story, he reveals the presence of previous enlightenment which enlightenment we desire to ascertain. Critics, the author feels, have credited the child with the wealth of experience that is the acquisition of mature years, and have judged what the child would see in the story by what they themselves saw. It is obviously impossible that the immature subject should read into these stories mature interpretations.

In the following paragraphs will be considered the problems and principles involved in these stories and the response or in some cases responses, that were used as the standard of a correct answer.

1. *Mamma and papa have told Mary who is eight years old that she must not lift baby John who is three, as he is too heavy, and she will hurt herself by doing it. One day while Mary and John were playing on the street in front of their house an automobile came along very fast. John ran out almost in front of it when Mary caught him in her arms and carried him to the sidewalk.*

Was Mary disobedient? Answer YES or NO......... Why?.........

Story No. 1 brings out (in answer to the question, *Was Mary disobedient?*) in how far the child understands the duty of obedience. The *Why?* discloses the ability of the child to interpret this obligation to obey in the face of an obvious danger. The subject is credited if he answers "No" to the question and gives a valid reason, *e.g.*, "Her brother might have been killed." Explicit statement of the moral principle, that a command is not to

be carried out in the face of circumstances evidently not contemplated by the one in authority, was not demanded.

Table No. 1 is typical of the form of Table used throughout this paper. The first column names the school system in which the tests were given. The other columns numbered from 6 through Ad (including 19 and over) present the age of the group, and are subdivided into boys, B, and girls, G. The figures in medium type are the absolute numbers answering the question correctly. The figures in heavy type give the percentages these absolute numbers are of the entire group which took this test. The total number taking the test can be readily calculated, since the number and percentage answering the question correctly have been given. The first four school systems,—S. Public, P. Public, G. Public, and Catholic, were given group tests only. The C. I. and C. I. W. groups represent Catholic schools from two large eastern cities; these were given individual tests only. The Catholic school tests represent results from a large commercial city of the Middle West, while the P. Public and G. Public and S. Public represent public school systems in cities just west of the Allegheny mountains. The first is a large industrial center, the second a semi-rural community, the third a suburb of the first.

Below the last school system mentioned, is the "Total for all Schools." This total is found by adding the number in each separate school system answering the test correctly and finding what percentage this is of the whole number taking the test. The top figure, therefore, gives the total number of boys or girls at any age answering the question correctly; the lower figure (in heavy type), the percentage this number represents in the whole group examined at that age. The last heading, "Total for both sexes," combines the results of the line above by giving the total number of children at each age answering the question correctly, and the percentage this is of the whole age group. It will be noticed that many ages are blank in the Table. This is always the case where no subjects of that age took the test. Where some subjects took the best but none succeeded in answering it correctly, a

TABLE NO. 1

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
School																												
										2	3	3	11	5	8	8	11	5	3	6	2	2						
S. Public										100.0	100.0	100.0	100.0	83.4	72.7	88.9	68.8	71.2	60.0	85.7	100.0	100.0						
							7	13	54	46	76	71	87	80	83	55	47	44	26	13	6	5						
P. Public							63.6	72.3	69.1	73.8	73.0	87.2	81.9	82.0	83.8	82.1	79.4	84.5	81.2	76.5	75.0	100.0						
									7	8	15	14	35	38	48	54	44	46	26	28	16	9	3	0	4	1	2	0
G. Public									100.0	66.7	75.0	60.9	89.6	84.4	82.6	88.7	89.8	80.5	78.8	96.6	80.0	90.0	75.0	.0	100.0	100.0	100.0	.0
							8	4	38	42	52	88	70	96	131	112	144	172	146	197	70	126	34	68	7	25	2	13
Catholic							72.7	80.0	73.0	84.0	82.7	89.8	78.4	90.2	94.3	95.2	93.6	98.0	99.3	99.5	90.1	98.3	87.0	97.2	100.0	96.2	100.0	92.8
	7	4	13	9	5	14	2	0	12	0																		
C. I.	87.5	100.0	72.3	47.3	55.6	70.0	40.0	.0	92.3	.0																		
	2	4	3	6	1	1	2	1	2	2	2	1																
C. I. W.	66.7	57.2	60.0	50.0	25.0	25.0	66.7	50.0	66.7	66.7	100.0	100.0																
Total for	9	8	16	15	6	15	19	18	113	100	148	177	203	219	270	229	246	267	201	244	94	142	37	68	11	26	4	13
all schools	81.8	72.7	69.6	48.5	46.1	62.6	62.7	69.3	75.1	73.5	77.0	80.0	82.8	88.0	88.0	86.3	88.8	97.5	92.1	97.4	87.4	98.0	86.2	97.2	100.0	96.3	100.0	86.7
Total for	17		31		21		37		213		325		422		499		513		445		236		105		37		17	
both sexes	77.4		57.4		56.7		66.2		73.5		78.7		85.2		86.3		92.8		94.8		93.7		92.8		97.3		89.4	

zero is recorded. A zero, therefore, means, that the test was attempted and failed, a blank that it was not attempted.

Examination of Table No. 1 discloses the fact that children are, at 6, very prone to obey the letter of the command without much interpretation or reasoning on the question. It is probable here that the high percentage at 6 as compared with those of 7, 8, and 9 is accidental. At the age of 11 it is the exceptional child, however, who is not able to interpret correctly the injunction of his parents, in the face of danger. As the child matures the conviction becomes more and more pronounced.

2. *In our school is "silly Willie"*
Whom the kids tease all the time
"Billy, Willie, you're so silly
That to love you'd be a crime."

Is it wrong or right for the boys to sing a song like this?
Why?......................................

This ditty, after the form which boys so often use to tease some less spirited schoolmate, purposes to find at what age children realize that they have a duty of charity toward another's feelings. No credit is given for the answer "Yes" to this question unless the child can answer *Why?* in a way which shows he realizes he has a duty of charity to his companion.

Children do not reach the point of appreciating this obligation of charity to a sufficiently great extent—(75 per cent is generally accepted as the line of demarcation, after which an act may be considered representative of an age group)—to make it a fair test of any group before the age of 13. Children at 6 are only slightly aware of the obligation but at 9 there is a marked development after which the improvement is more gradual. These results are presented in Table No. 2.

Table No. 3 records in detail the principles expressed by the children and the percentages at the different ages. These results are presented for boys and girls separately at all the ages, and are the total for the schools (except S. Public) presented in Table No. 2. The principles are presented in the Table by Roman numerals which include the following ideas, respectively:

TABLE NO. 2

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
										0	2	2	4	6	6	6	8	2	1	1	0	1						
S. Public										.0	66.7	66.7	33.3	100.0	60.0	100.0	88.9	50.0	100.0	100.0	.0	100.0						
							7	6	58	49	71	72	65	73	67	50	37	40	18	14	7	5						
P. Public							63.6	75.0	74.2	70.1	67.5	74.9	61.1	79.6	67.7	74.5	62.5	76.8	56.3	66.6	87.5	100.0						
									4	10	15	19	25	34	21	51	34	40	19	23	16	9	3	0	2	0	2	0
G. Public									57.2	83.3	75.0	82.7	64.0	75.5	63.6	83.6	72.0	70.0	55.9	82.1	76.2	90.0	75.0	.0	50.0	.0	100.0	.0
							7	3	22	33	36	65	59	76	108	94	112	145	114	165	60	115	24	57	6	24	2	13
Catholic							63.6	60.0	42.2	66.0	58.0	66.3	67.3	71.4	77.8	80.8	73.9	82.7	77.5	85.2	79.2	89.7	61.4	81.5	85.7	92.4	100.0	92.8
	2	1	5	1	4	5	3	2	8	1																		
C. I.	25.0	25.0	27.8	5.3	44.4	25.0	60.0	100.0	61.5	100.0																		
	0	0	1	1	1	2	2	1	2	1	2	1																
C. I. W.	.0	.0	20.0	8.3	25.0	50.0	66.7	50.0	66.7	33.3	100.0	100.0																
Total for	2	1	6	2	5	7	19	12	94	94	126	159	153	189	191	201	191	277	152	203	83	130	27	57	8	24	4	13
all schools	18.2	9.1	26.1	6.5	38.5	29.2	62.7	70.6	62.5	69.1	65.5	72.2	63.0	72.9	70.9	80.4	70.7	81.7	70.8	83.2	78.9	89.7	62.9	81.5	81.8	88.8	100.0	86.7
Total for	3		8		12		31		188		285		342		392		468		355		213		84		32		17	
both sexes	13.7		14.8		32.4		66.0		64.9		69.3		68.1		76.3		77.2		77.4		85.6		73.9		84.2		89.4	

TABLE NO. 3

Principle	I		II		III		IV		V	
Sex	B	G	B	G	B	G	B	G	B	G.
Age	0	0	0	0	0	1	0	0	0	0
6	.0	.0	.0	.0	.0	9.1	.0	.0	.0	.0
	2	0	0	0	4	2	0	0	0	0
7	8.7	.0	.0	.0	17.4	6.5	.0	.0	.0	.0
	2	2	0	1	4	2	0	0	0	0
8	15.4	8.3	.0	4.2	30.8	8.3	.0	.0	.0	.0
	1	2	5	0	7	4	3	8	2	5
9	3.3	11.8	16.5	.0	23.1	23.5	9.9	47.0	6.6	29.4
	15	18	8	7	28	25	20	19	19	20
10	9.8	13.3	5.2	5.2	18.2	18.5	13.0	14.1	12.4	14.8
	24	16	12	25	31	36	19	49	20	18
11	12.7	7.4	6.4	11.5	16.4	16.6	10.1	22.5	10.6	8.3
	32	31	24	25	32	58	34	30	26	23
12	13.8	12.2	10.3	9.9	13.8	22.9	14.6	11.9	11.2	9.1
	49	30	56	44	58	47	25	50	22	24
13	18.1	12.3	20.7	18.0	21.5	19.3	9.3	20.5	8.1	9.8
	47	37	46	49	52	47	29	47	27	39
14	18.0	13.1	17.7	17.3	20.0	16.6	11.1	16.6	10.4	13.8
	42	18	29	62	33	37	29	42	15	39
15	19.7	7.5	13.6	25.7	15.4	15.4	13.6	17.4	7.0	16.2
	16	22	14	42	16	24	18	20	14	13
16	15.2	15.4	13.3	29.4	15.2	16.8	17.1	14.0	13.3	9.1
	13	11	4	14	3	10	3	15	2	8
17	30.3	15.7	9.3	20.0	7.0	14.3	7.0	21.5	4.7	11.4
	3	3	4	5	1	6	1	5	0	3
18	27.3	11.1	36.4	18.5	9.1	22.2	9.1	18.5	.0	11.1
	1	2	0	4	3	5	0	1	0	2
Ad.	25.0	13.3	.0	26.7	75.0	33.3	.0	6.7	.0	13.3

I. They should not insult the boy; they may make him angry; they may make him sensitive; they are speaking ill of their neighbor.

II. God made Willie that way; he cannot help being silly; we should be charitable to the unfortunate.

III. They are making fun of Willie; they are teasing him.

IV. He won't like it; they are hurting his feelings.

V. The boys would not like it if they were teased like that; it shows ignorance, ill-breeding, etc.

A few children thought it a very good thing to tease Willie because by doing so he would become aware of his foolishness and be spurred on to correct it. These answers were given no credit. It was felt that their idea of charity was misconceived in spite of its expressed intention of helping the boy.

The highest percentages at all ages up to 15 place their reason under either principle III or IV. At 15 the highest percentage is under principle II,—God made Willie that way, or, he cannot help being silly. The girls are aware of this principle earlier than the boys. Its appearance may mark perhaps the beginning of the tendency to consider the individual not as a unit sufficient to himself, but as a member of a group having certain endowments and limitations, and subject to the play of environmental conditions on him.

3. *Daddy had just come home with a nice big bundle under his arm. Ruth and Dick could hardly wait till he hung up his coat and hat, and opened the bundle. But at last the wait was over and kneeling beside daddy's chair they watched him break the string and take off the paper. Two new books were there. One had a beautiful elephant on the cover and the other was just plain. Ruth was older than Dick so daddy said she could pick which she wanted.*

If you were Ruth which one do you think you should pick?

Why? ....

This little story is one that appeals very much to the children. The interest in general runs so high that in their eagerness to tell which book they like and would take, the children cannot see the problem involved. The reason the child gives for his choice brings out in clear relief the motive from which he acts. The subject is credited only when this motive is unselfish.

It is rather remarkable that this little story (Table No. 4) is one which is not solved until the adult period. The instinct of the individual to take what he desires, however he may justify doing so, is a fundamental one. The little children pick the "one with the elephant on, because it is the prettiest." That Dick might also like the "prettiest" one does not occur to most of them. Later the child no longer picks the "elephant," but instead, picks "the plain one." But again consideration for the little brother is secondary. The plain book is more interesting, or contains "stories, and I like to read," or "it will help me with my lessons." The motive in this second period is a more refined one; it is not mere satisfying of desires for the pleasure of doing so, but the satisfying of them because reason points out a future gain joined

TABLE NO. 4

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
										0	1	0	4	5	6	5	5	3	1	0	2	1						
S. Public										.0	33.3	.0	40.0	83.3	60.0	83.5	45.5	75.0	33.3	.0	100.0	50.0						
							4	7	30	31	42	42	45	41	33	52	24	22	11	6	2	3						
P. Public							40.0	38.9	38.4	45.0	40.3	44.1	42.3	44.7	33.7	77.5	40.6	51.3	34.4	28.6	25.0	60.0						
									6	8	15	15	23	26	29	26	33	41	19	16	9	7	3	1	4	1	2	1
G. Public									85.7	66.7	75.0	65.3	58.4	57.7	55.7	59.0	67.3	71.8	55.9	59.2	45.0	70.0	75.0	100.0	80.0	100.0	100.0	100.0
							6	1	13	23	35	51	36	53	69	62	71	108	62	120	31	75	21	42	4	13	1	11
Catholic							45.5	20.0	27.0	46.0	54.6	53.6	41.0	50.4	49.7	53.3	46.9	61.6	42.2	61.2	40.9	58.5	83.7	60.1	57.2	50.1	50.0	78.5
	1	0	2	2	2	3	3	0	3	0																		
C. I.	12.5	.0	11.1	10.5	18.2	15.0	60.0	.0	23.1	.0																		
	1	0	1	0	0	0	0	0	1	1	1	1																
C. I. W.	33.3	.0	20.0	.0	.0	.0	.0	.0	33.3	33.3	50.0	100.0																
Total for	2	0	3	2	2	3	13	8	53	63	94	115	108	125	137	145	133	174	93	142	44	86	24	43	8	14	3	12
all schools	18.2	.0	13.1	6.5	15.4	12.5	44.9	29.6	35.5	46.0	48.9	52.0	44.5	50.4	45.8	60.9	49.2	62.1	43.2	58.0	41.4	59.3	58.6	60.6	91.7	51.8	75.0	80.0
Total for	2		5		5		21		116		209		233		282		307		235		130		67		22		15	
both sexes	9.1		9.3		13.5		37.6		40.6		50.8		47.5		52.5		55.9		51.0		51.7		59.6		56.3		78.9	

with present satisfaction. Selfishness has been replaced by utility. In the meantime "little Dick" may look out for himself as far as thoughtless Ruth is concerned.

4. *Robert is fourteen years old. His father died when he was only ten years old and his mother has been sick and not able to walk for a long time. After school Robert never stays out to play with the boys but hurries home to read to his mother and try to make her happy. The boys call him a "big sissy" Is it wrong or right for the boys to call him a "sissy"?...... Why?......*

A very strong appeal to the sympathies of the child is made in this story. Mother being sick for a long time is a tragedy of home-life which requires but little of the child's over-active imagination to picture. The recognition of the duty Robert owes his mother, while it was meant to be secondary to the concept of charity, is given full credit also.

The instinct to love one's mother and the duty one has to help her even in the face of ridicule are very evident even at the age of 6 (Table No. 5). From the age of 9 on they are practically universal traits. Although this story was designed to bring out the obligation of charity in our acts and judgments, it does so in scarcely 20 percent of the cases studied. And even when the reason is given that "It is unkind to call Robert a 'sissy,'" it is usually supplemented with the remark, "It may make him dissatisfied and prevent him from performing his duty to his mother."

The answers were classified in Table No. 6 under the following headings:

I. He is doing his duty; he is doing right; he is doing a favor; his mother was sick.

II. He loves his mother.

III. He was trying to help his mother; he was making his mother happy.

IV. It is uncharitable; it may keep him from doing his duty; he is not a "sissy" but a noble boy.

V. The boys would not like to be called that; they would stay home also if their mother was sick.

TABLE NO. 5

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										0 .0	3 100.0	3 100.0	10 100.0	6 100.0	9 90.0	6 100.0	12 100.0	4 100.0	3 75.0	0 .0	0 .0	1 100.0						
P. Public							10 100.0	18 100.0	74 97.7	63 98.4	99 95.0	93 97.7	102 95.9	88 95.9	91 92.8	65 96.9	57 96.3	48 94.1	29 90.6	17 100.0	2 25.0	5 100.0						
G. Public									6 75.0	12 100.0	20 100.0	20 87.0	38 97.3	42 93.2	51 96.4	60 91.2	49 92.6	53 92.8	31 91.1	24 88.8	20 100.0	9 90.0	5 100.0	1 100.0	5 100.0	1 100.0	2 100.0	1 100.0
Catholic							9 90.0	4 80.0	34 72.4	43 87.7	53 88.5	85 91.8	80 92.0	102 96.9	131 95.6	112 96.3	148 96.2	172 98.0	140 95.2	192 97.9	72 95.8	122 95.2	37 99.9	69 98.7	7 100.0	25 96.2	1 50.0	14 100.0
C. I.	7 87.5	2 50.0	14 77.8	12 63.1	8 .88.9	15 83.4	5 100.0	0 .0	12 100.0	1 100.0																		
C. I. W.	3 100.0	6 85.7	4 80.0	11 91.6	3 75.0	2 50.0	3 100.0	2 100.0	3 100.0	3 100.0	2 100.0	1 100.0																
Total for all schools	10 90.9	8 72.7	18 78.3	23 74.3	11 84.6	17 77.4	27 96.4	24 88.8	129 87.7	121 93.2	177 93.8	202 94.1	230 94.9	188 96.8	282 94.2	243 88.9	266 95.8	277 96.4	203 93.8	233 95.1	94 91.2	137 94.5	42 100.0	70 98.7	12 100.0	26 96.2	3 75.0	15 100.0
Total for both sexes	18 81.9		41 75.1		38 80.1		51 92.8		250 90.8		404 90.5		418 94.5		525 91.9		543 95.6		436 95.0		231 93.6		112 99.1		38 97.3		18 94.7	

At the younger ages it is the fact that he "helps his mother" and "makes her happy" that appeals to the children. This ideal persists through all the ages but in the adolescent period the concept of duty and of the unfairness of the situation becomes prominent also. In later adolescence the supreme ideal expressed in the words "he loves his mother," receives considerable emphasis.

TABLE NO. 6

Principle	I		II		III		IV		V	
Sex	B	G	B	G	B	G	B	G	B	G
Age	2	2	0	0	5	3	1	1	0	0
6	18.2	18.2	.0	.0	45.5	27.3	9.1	9.1	.0	.0
	7	8	0	0	8	13	3	0	0	0
7	30.5	25.8	.0	.0	34.8	42.0	13.1	.0	.0	.0
	3	6	0	0	7	7	1	3	0	0
8	23.1	27.3	.0	.0	53.8	31.9	7.7	13.7	.0	.0
	6	4	2	3	20	12	0	10	1	0
9	21.4	14.8	7.1	11.1	71.4	48.1	.0	37.0	3.6	.0
	27	29	9	11	82	77	6	5	9	0
10	18.9	22.6	6.3	8.6	57.4	60.1	4.2	3.9	6.3	.0
	27	29	8	30	98	121	22	19	3	1
11	14.6	13.7	4.3	14.2	52.9	57.1	11.9	89.7	1.6	0.5
	44	42	12	16	145	141	11	18	7	3
12	19.0	21.8	5.2	8.3	62.6	73.3	4.8	9.4	3.0	1.6
	59	49	30	28	158	141	34	26	4	0
13	20.5	19.7	10.4	11.3	55.0	56.7	11.8	10.5	1.4	.0
	55	48	23	34	86	141	35	0	0	0
14	20.6	16.8	8.6	11.9	32.3	49.5	13.1	.0	.0	.0
	34	48	22	34	112	117	34	37	0	1
15	16.0	19.8	10.4	4.0	52.9	48.3	16.0	15.3	.0	0.4
	25	29	12	18	48	53	17	37	0	0
16	24.3	20.3	11.6	12.6	46.7	37.1	16.5	25.9	.0	.0
	7	20	9	8	10	31	3	15	9	1
17	16.7	28.2	21.4	11.3	23.8	43.7	7.1	21.2	21.4	0.4
	5	8	3	5	3	5	2	6	1	0
18	41.7	29.6	25.0	18.5	25.0	18.5	16.7	22.2	8.3	.0
	0	4	1	3	3	3	0	6	0	0
Ad.	.0	26.7	25.0	20.0	75.0	20.0	.0	40.0	.0	.0

It is self-evident from this enumeration of reasons that the concept of charity is quite subordinate to, and develops much later than the concept of love of home and of family.

5. *A very poorly dressed woman, carrying a basket of apples was walking along the street. She looked as tho she were so tired she could hardly walk. Two pretty girls dressed up in their nicest dresses watched the woman as she passed them. "Isn't she ugly—and, oh, what an awful dress to wear," the one little girl said to the other, loud enough for the old lady to hear.*

Do you like these little girls? ...... *Why?* ......

The respect which youth should pay to age, and the obligation of anyone to respect the feelings of others, more particularly of the well-dressed not to make disparaging remarks about the poor within their hearing, are the phases of charity toward our neighbor which are exemplified in this story. The answer of the subject will show in how far he has learned these fundamental duties of the social order. The answer "No" with a reason showing that the principles involved are in some degree understood, is credited as correct.

Table No. 7, with its high percentages at even 6 and 7 years, impresses one with the fact that the obligation of charity when presented in a simple, specific situation is recognized early. The various forms the expression of this obligation takes at the different ages have been compiled in Table No. 8 under the following headings:

I. They are making fun of the lady; they make fun of people.

II. They should help her; they should carry the basket; they should respect older people.

III. She is poor; she has no better clothes; they should feel sorry for the poor, old woman.

IV. They speak ill of others; it is not nice to talk about people's clothes; because they said that.

V. They are proud, snippy, vain, mean, bold, rude, cruel, impolite, etc.

VI. They hurt the old lady's feelings.

VII. They would not like someone to say that to them when they get old, or to their mother.

TABLE NO. 7

Age / Sex / (School)	6 B	6 G	7 B	7 G	8 B	8 G	9 B	9 G	10 B	10 G	11 B	11 G	12 B	12 G	13 B	13 G	14 B	14 G	15 B	15 G	16 B	16 G	17 B	17 G	18 B	18 G	Ad. B	Ad. G
S. Public										0 .0	2 66.7	1 100.0	9 90.0	6 100.0	9 90.0	6 100.0	10 90.9	4 100.0	3 100.0	3 100.0	2 100.0	2 100.0						
P. Public							7 70.0	17 94.5	75 99.9	67 95.8	97 94.1	93 97.7	102 95.9	87 97.4	95 97.9	65 98.8	54 91.3	49 96.0	28 87.6	17 100.0	7 87.5	5 100.0						
G. Public									8 100.0	12 100.0	18 90.0	22 95.7	33 84.5	41 91.0	52 96.2	59 96.6	49 92.6	52 87.9	27 79.4	25 96.2	18 90.0	9 90.0	5 100.0	1 100.0	4 80.0	0 .0	2 100.0	1 100.0
Catholic							9 90.0	5 100.0	38 82.5	40 83.2	52 80.1	83 90.5	81 93.2	83 92.2	120 87.6	110 94.6	145 94.3	166 94.6	137 94.5	194 98.9	70 94.5	122 95.2	34 94.4	69 100.0	7 100.0	24 92.4	2 100.0	14 100.0
C. I.	8 100.0	3 75.0	11 61.2	17 94.5	6 66.7	16 89.0	4 80.0	2 100.0	11 91.6	1 100.0																		
C. I. W.	3 100.0	5 83.4	4 80.0	8 66.6	2 50.0	1 25.0	2 66.7	2 100.0	3 100.0	3 100.0	2 100.0	1 100.0																
Total for all schools	11 100.0	8 80.0	15 65.3	25 82.5	8 61.5	17 77.4	22 78.5	26 96.2	135 93.2	123 91.0	171 90.6	200 94.4	225 92.9	217 88.1	276 92.5	240 96.5	258 93.4	271 94.0	195 90.7	214 98.0	97 93.1	138 95.2	39 95.2	70 100.0	11 91.6	24 88.8	4 100.0	15 100.0
Total for both sexes	19 90.4		40 75.6		25 71.5		48 87.4		258 91.8		371 92.4		442 90.6		516 94.4		529 93.6		409 97.8		235 94.5		109 98.1		35 89.6		19 100.0	

TABLE NO. 8

Principle	I		II		III		IV		V		VI		VII	
Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G
Age	2	0	0	1	1	0	3	3	5	3	0	0	0	0
6	18.2	.0	.0	10.0	9.1	.0	27.3	30.0	45.5	30.0	.0	.0	.0	.0
	3	8	4	3	2	0	3	11	3	4	0	0	0	0
7	13.1	26.4	17.4	9.9	8.7	.0	13.1	36.3	13.1	13.2	.0	.0	.0	.0
	4	4	0	2	0	0	5	3	0	6	0	0	0	0
8	30.8	18.2	.0	9.1	.0	.0	38.5	13.7	.0	27.3	.0	.0	.0	.0
	3	3	3	2	4	5	1	5	13	12	0	0	0	1
9	10.7	11.1	10.7	7.4	14.3	18.5	3.6	18.5	46.4	44.4	.0	.0	.0	3.7
	16	18	17	19	23	19	20	24	53	36	2	0	4	0
10	10.4	13.5	11.1	14.3	15.3	14.3	13.2	18.0	36.0	27.0	1.4	.0	2.8	.0
	19	22	18	24	16	36	18	25	77	58	5	8	2	1
11	10.1	10.4	9.5	11.4	8.5	17.1	9.5	11.9	40.8	27.5	2.7	3.7	1.1	0.5
	32	30	36	40	39	44	44	23	85	78	3	3	5	5
12	13.8	12.5	15.6	16.7	16.8	18.3	19.0	9.6	36.7	32.5	1.3	1.3	2.2	2.1
	31	16	42	48	46	53	34	27	108	87	5	3	0	5
13	10.8	6.6	14.6	19.7	16.0	21.8	11.8	11.1	37.5	35.8	1.7	1.2	.0	1.1
	20	22	43	61	47	46	26	28	99	107	9	5	4	1
14	7.5	7.7	16.1	21.4	17.6	16.1	9.8	9.8	37.1	37.6	3.4	1.8	1.5	0.4
	11	5	33	66	20	33	19	32	95	107	7	1	3	0
15	5.2	2.1	15.6	27.4	9.4	13.7	9.0	13.3	44.8	44.4	3.3	0.4	1.4	.0
	8	4	27	33	7	7	10	15	42	65	2	7	0	2
16	7.8	2.8	26.5	23.1	6.9	6.3	9.8	10.5	41.2	45.5	2.0	6.3	.0	1.4
	1	0	10	23	3	8	1	9	18	29	0	2	0	3
17	2.4	.0	24.4	32.9	7.3	11.4	2.4	12.9	43.9	41.5	.0	2.9	.0	4.3
	1	1	3	11	0	0	2	1	6	9	1	0	0	1
18	8.3	3.7	25.0	40.7	.0	.0	16.7	3.7	50.0	33.3	8.3	.0	.0	3.7
	1	1	0	4	0	1	0	0	3	9	0	0	0	1
Ad.	25.0	6.7	.0	26.7	.0	6.7	.0	.0	11.1	60.0	.0	.0	.0	6.7

If the predominance of principle V which is really a miscellaneous group, is not considered, principle I, II and III predominate in the pre-adolescent period. These groups are very specific acts of unkindness, *e.g.*, making fun of the lady, not helping with her basket, and not caring that she was poor. During the adolescent period principles I and III are thrown aside while prin-

ciple II increases in importance. This increase is accompanied by the generalization of the principle involved in "not carrying her basket," to "lack of proper respect for one's elders." The transition is a gradual one but it marks the growth of a moral concept from the single act to the social duty.

6. *When Columbus came to America the Indians treated him very kindly. One little boy in the tribe who had, of course, never seen a white man before, or any man dressed like Columbus was, loved him very much. Whenever Columbus passed near where he was the little boy would fall on his knees and cover his face, and pray to Columbus that it would not rain the next day for he wanted to go hunting.*

Who did the boy think Columbus was? ....

It is at once apparent to the adult mind that the Indian in this story is giving to the familiar historical character Columbus, the worship due to God alone. By the nature of his reply, the subject will show what correlation exists in his mind between the concept of God and that of worship.

The answer "God" in any of its various forms was accepted as correct in this problem. Such forms are, for instance, "The Great Spirit," "The Almighty," "Manitou," "The Holy Spirit," "Our Lord," "Christ." Such answers as "A Spirit," "An Angel," "A powerful man," etc., were given no credit. If two answers as "An angel or our Lord," were given they were counted correct, because, while the child gives evidence of doubt that anyone could consider Columbus God, yet he recognizes definitely that the worship given is that of a creature to his Maker.

Table No. 9 shows that the recognition of such worship is not general before the age of 12. This recognition, according to our Table has a gradual growth and is probably due to development of the powers of reasoning and training in religion rather than to any spiritual awakening.

7. *The four boys had been playing hard all evening and were very hungry by nine o'clock, yet they did not care to go home. Jim proposed that they have a "lark." He was game, if the others would back him up to sneak around the corner of old Domico's fruit stand and roll out a watermelon. If they once got it they could run faster than the old Italian, so there was no danger of being caught.*

Do you think this was a good thing for the little boys to do?.... *Why?*....

TABLE NO. 9

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										1	3	0	8	5	10	9	15	7	4	7	2	2						
										50.0	100.0	.0	80.0	83.4	100.0	100.0	93.8	100.0	80.0	100.0	100.0	100.0						
P. Public							5	12	50	48	70	75	81	63	83	59	45	41	27	12	8	5						
							50.0	66.7	67.5	70.6	67.2	78.8	78.6	69.3	86.3	89.7	76.1	80.4	87.2	75.0	100.0	100.0						
G. Public									6	8	16	14	26	31	25	47	51	43	32	29	18	2	6	2	4	0	1	0
									75.0	72.7	84.2	60.9	89.6	82.3	73.5	77.1	89.3	81.3	94.1	100.0	90.0	33.3	100.0	100.0	80.0	.0	50.0	.0
Catholic							6	3	24	32	47	65	69	83	113	104	135	154	131	184	66	118	32	64	7	24	2	14
							60.0	75.0	57.1	66.6	79.4	72.8	78.4	79.7	83.6	89.4	87.8	92.4	90.4	93.8	87.8	92.0	94.1	91.5	100.0	92.4	100.0	100.0
C. I.	2	1	5	4	3	8	2	0	7	1																		
	40.0	50.0	83.4	26.7	75.0	47.0	40.0	.0	58.3	100.0																		
C. I .W.	1	2	3	4	3	1	2	2	2	2	2	1																
	33.3	33.3	60.0	33.3	75.0	25.0	66.7	100.0	66.7	66.7	100.0	100.0																
Total for all schools	3	3	8	8	6	9	15	17	89	92	138	155	184	182	231	219	246	245	194	232	94	127	38	66	11	24	3	14
	42.9	37.5	72.7	29.6	75.0	42.8	53.6	65.5	64.1	69.0	73.1	73.5	76.5	73.5	84.1	86.7	86.3	88.0	90.2	92.8	89.3	90.2	90.4	91.7	91.6	92.4	75.0	93.4
Total for both sexes	6		16		15		32		181		293		366		450		491		426		221		104		35		17	
	37.5		42.1		51.8		59.2		67.3		73.5		75.4		85.5		87.4		91.6		89.9		91.5		92.1		89.4	

The emotions of the child are called into play in this story. The idea of play, of exhaustion, of hunger, and especially of doing something daring for the sake of a "lark" all veil the real evil lurking in the background. Unless the right of property is firmly fixed in the subject's mind, we may look for the emotions to override it. The answer to be credited, must show the kind of a wrong act, *i.e.*, *s*tealing, which the boys are doing.

The right of property is evidently so sacred a one that children are not very long in doubt as to its importance. At the age of 9 (Table No. 10) we find that the mass of our subjects are aware of what the boys in the story are doing and condemn it as wrong. Even at 6 this principle is pretty well fixed in the minds of most children. Growth seems to be delayed however up until 9 when there is quite a definite increase in the percentage answering the question correctly. But a very small percentage of the cases considered, give as the reason why this act is wrong that "they might get caught." The attitude of the average child is, therefore, the correct one and differs materially from the unwholesome one so often found in the delinquent child.

This point in our stories marks the end of the simple problems and the beginning of those which are comprehended only by more mature minds. The transition is a rather sudden one as we shall see from the Tables to be considered. These harder stories were given to all age groups, but it was not permitted that the grammar grades waste time on them. As soon as it was apparent that the children were not accomplishing anything the papers were collected. The only reason for giving to these children problems admittedly too difficult for them was to find out, if possible, at what age the principles involved make their appearance. It is possible to theorize very well concerning the age at which they appear but in order to study the question it is necessary to begin with an age at which they do not appear and trace their beginnings. This is what we have tried to do with these problems.

8. *A gentleman through a very clever bit of business practice succeeded in legally swindling another man out of a considerable piece of property. It happens that the town grows around this property, and it becomes very valuable. After ten years have elapsed, the gentleman dies bequeathing the prop-*

TABLE NO. 10

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public											3	0	8	5	7	9	12	6	8	4	1	1						
											100.0	.0	88.9	83.4	70.0	100.0	85.7	85.7	88.9	73.3	100.0	100.0						
P. Public							7	14	59	53	83	82	80	73	81	50	46	46	23	13	6	5						
							70.0	87.5	78.6	77.9	80.5	86.1	79.2	81.0	85.1	78.0	79.1	90.2	74.3	81.3	62.5	100.0						
G. Public							0		7	9	16	19	35	41	52	58	49	50	28	21	14	10	4	2	5	0	2	0
							.0		82.5	90.0	84.1	82.6	89.6	82.3	98.3	92.7	90.7	87.5	62.3	77.7	77.8	83.3	73.3	100.0	100.0	.0	100.0	.0
Catholic							8	4	30	29	52	75	70	84	110	107	119	147	115	174	67	115	30	64	7	26	2	12
							80.0	100.0	73.2	70.8	89.4	84.0	82.6	80.6	81.4	93.1	79.7	85.3	79.4	88.7	91.8	89.7	88.2	91.5	87.5	100.0	100.0	85.7
C. I.	7	1	17	6	7	12	5	2	11	0																		
	87.5	25.0	94.5	33.4	77.8	66.7	100.0	100.0	91.6	.0																		
C. I. W.	3	2	2	7	3	2	3	2	3	2	1	2																
	100.0	33.3	40.0	58.3	75.0	50.0	100.0	100.0	100.0	66.7	100.0	100.0																
Total for all schools	10	3	19	13	10	14	23	22	110	93	155	178	193	203	250	224	225	249	174	212	88	131	34	66	12	26	4	12
	90.9	30.0	82.7	42.9	76.9	63.7	82.1	91.7	79.2	74.4	83.7	85.3	82.8	83.2	85.3	90.0	82.1	86.9	79.3	86.3	86.2	91.0	80.9	91.7	92.2	100.0	100.0	80.0
Total for both sexes	13		32		24		45		203		333		396		474		474		386		219		100		38		16	
	61.9		60.5		64.8		86.4		76.9		84.9		82.8		87.7		84.4		83.0		88.0		88.0		97.3		84.2	

erty to his grandson. In going over his grandfather's diary the young man discovers the entire record of the transaction. In the diary the grandfather stated that he knew he was really stealing the property. The heirs of the real owner are still living. Is the young man morally bound to restore all the property or its original value, or nothing at all?........ Why?........

In Story 8 a situation is given which is by no means phenomenal in the history of property inheritances. What is the moral obligation of the young heir to the other family? He must restore *all* the property—with the possible exception of a nominal salary in recompense for his grandfather's work as administrator of the estate. To hold the property without just title, even though he did not himself steal it, would be holding stolen goods—an act certainly contrary to the moral law.

The record of this test given in Table No. 11, proves it too difficult for the normal adult to solve. In the answers received, many cases—a larger number than that which answered the test correctly according to our standard—saw that the young heir would be receiving stolen goods and must make reparation. But the reparation did not extend further than the original value of the property stolen. Hence these answers received no credit. To solve the problem correctly evidently requires a fine appreciation of one's duty to repair a damage done, even when one is not himself responsible for it. This test may be considered a suitable one with which to test superior adult concepts of reparation for stolen goods.

9. *If you met a friend on the street, and she had on a new dress which you considered most unbecoming, and she asked you how you liked it what should your answer be? ....*

The principle involved in this story, the sacredness of truth, is one which most persons are tempted to violate many times a day under modern living conditions. The situation is purposely deceptive, there being an apparent conflict between the duty to be truthful and an obligation of charity toward our neighbor. We have the thought of the problem in the old adage, "It is never permitted to tell a lie, but it is often unlawful to tell the truth."

TABLE NO. 11

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public																0	0	0	0	0	0	0		1				
																.0	.0	.0	.0	.0	.0	.0		50.0				
P. Public							3	1	14	10	21	19	12	16	20	11	12	11	6	4	1	1						
							42.9	25.0	38.9	30.3	31.9	32.7	16.2	20.8	26.4	20.8	20.3	26.8	22.2	36.4	12.5	33.3						
G. Public									3	2	4	2	15	13	2	21	24	32	31	19	16	12	4	4	8	0	1	0
									60.0	33.3	26.7	11.8	39.5	30.3	3.8	35.1	14.7	57.3	77.5	62.7	54.5	60.0	44.4	57.2	61.5	.0	25.0	.0
Catholic							0	0	1	4	12	16	21	28	38	45	54	57	42	56	55	74	26	40	7	15	0	7
							.0	.0	2.7	9.8	20.6	18.4	25.2	26.9	28.5	39.6	35.6	33.1	28.6	18.3	67.7	57.7	61.9	57.2	77.8	57.8	.0	50.0
C. I.			0	1																								
			.0	100.0																								
C. I. W.	0	0	0	0	0	0	0			0																		
	.0	.0	.0	.0	.0	.0	.0			.0																		
Total for all schools	0	0	0	1	0	0	3	1	18	16	32	37	48	57	60	77	90	100	79	79	76	87	30	45	15	15	1	7
	.0	.0	.0	100.0	.0	.0	17.6	14.3	23.0	19.5	23.0	23.1	24.5	25.4	22.9	33.6	34.7	36.0	36.7	32.0	60.8	57.8	58.8	57.1	68.3	55.5	16.8	46.7
Total for both sexes	0		1		0		4		34		69		105		137		190		158		163		75		30		8	
	0		100.0		0		16.7		21.4		23.0		25.1		27.9		35.2		33.7		58.7		57.8		61.2		38.1	

The solution lies in avoiding the situation. This may be done in the case in question in various ways, *e.g.*, by admiring some part of the dress which can be honestly admired.

It was found that so small a percentage of the cases studied solved this problem satisfactorily, that the results are worthless from this standpoint. The situation presented to most of the subjects the two alternatives—tell a lie for the sake of charity or tell the truth and wound charity. The numbers and percentages offering these two solutions have been tabulated with the following results:

Age	9	10	11	12	13	14	15	16	17	18	Ad.
	1	27	57	74	228	142	152	71	62	15	14
Tell Truth	5.0	18.9	22.7	26.3	49.0	28.1	34.2	26.2	46.5	33.3	58.4
	16	81	162	210	243	295	228	161	55	27	10
Be Charitable	80.0	56.7	64.6	74.8	52.2	58.4	51.3	59.4	41.3	60.0	41.7

The ideal of kindness to another is much more important to the younger child than is the obligation to tell the truth. Truth becomes more sacred as the child matures, and in this case the relative importance of charity is lowered. At 17 the percentages are about equal but in the adult age truth predominates.

10. *Suppose a boy in 1917, was certain that his father was pro-German and was going to inform the captain of a submarine the date of departure of a convoy. How should he act?........*

The recent war with Germany, the cause as it was of many tragedies and conflicts in homes throughout our country, suggested this problem. The case given is an extreme one, yet the principle adhered to here should also be adhered to were the consequences less important. In time of war our country has a higher claim upon us than our parents in any such dilemma as that presented in the test. The boy in this case must do his duty to his country, without sacrificing his father if that is possible, but if not, by sacrificing him.

The realization of this duty does not come to the average child until his eighteenth year (Table No. 12). This is, of course, the age at which the child is first called into service by his country in

TABLE NO. 12

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
					1				1	1	10	8	3	7	2	2		1				
S. Public					100.0				50.0	33.3	90.9	88.9	75.0	88.9	75.0	75.0		100.0				
	0	0	4	1	14	7	25	14	27	6	16	5	11	4	4	1						
P. Public	.0	.0	19.0	5.6	35.0	16.3	43.0	26.9	41.6	20.7	39.0	16.2	44.0	50.0	66.7	33.3						
			2	0	3	3	18	15	27	24	36	23	27	20	24	12	5	8	7	0	5	1
G. Public			50.0	.0	25.0	17.6	48.6	36.6	54.0	41.3	43.5	68.0	69.1	57.2	77.5	54.6	62.5	100.0	77.8	.0	100.0	50.0
	0	0	4	0	10	5	24	15	60	32	70	61	89	89	59	79	32	40	9	20	2	7
Catholic	.0	.0	12.5	.0	19.2	7.0	29.5	14.7	46.8	29.1	46.9	36.6	62.3	46.3	74.9	61.6	74.6	58.0	100.0	77.0	100.0	58.3
Total for	0	0	10	1	28	15	67	44	115	63	132	97	130	120	73	110	37	48	16	20	7	8
all schools	.0	.0	17.5	1.6	26.6	11.4	38.2	23.3	46.8	31.5	51.7	37.3	56.6	50.0	68.6	57.2	72.5	62.4	89.0	74.0	100.0	57.1
Total for	0		11		43		111		178		229		250		183		85		36		15	
both sexes	.0		9.4		18.1		30.4		40.1		44.7		53.5		66.6		66.3		80.0		71.4	

TABLE NO. 13

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (Principle)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
Consider	0	0	4	1	6	5	9	7	15	9	11	7	11	6	7	8	3	4	1	1	0	0
father first	.0	.0	7.0	1.6	5.8	3.0	5.4	3.7	6.2	4.6	4.0	3.0	4.9	2.5	6.0	5.2	5.9	5.2	5.7	3.7	.0	.0
Seek	0	0	0	0	0	0	0	1	0	0	5	1	1	1	2	0	0	1	0	0	0	0
advice	.0	.0	.0	.0	.0	.0	.0	0.5	.0	0	1.8	0.4	0.4	0.4	1.7	.0	.0	1.3	.0	.0	.0	.0
Did not understand	10	4	41	54	60	93	95	132	99	128	92	135	64	104	21	48	7	23	0	4	0	3
question	83.3	100.0	71.8	88.6	57.6	70.7	57.0	70.0	40.6	64.9	33.6	53.9	28.3	44.1	18.1	31.4	13.7	29.9	.0	14.8	.0	23.1
Serve coun-	0	0	10	1	28	15	67	44	115	63	132	97	130	120	73	110	37	48	16	20	7	8
try first	.0	.0	17.5	1.6	26.6	11.4	38.2	23.3	46.8	31.5	51.7	37.3	56.6	50.0	68.6	59.2	72.5	62.4	89.0	74.0	100.0	57.1

case of emergency. We would expect to find at this age at the latest a realization of one's duty to his country in a situation similar to that presented here.

The answers given were classified into four groups: (1) the obligation to serve one's country without regard for the father; (2) the obligation to save the father at the expense of one's country; (3) the solution which would seek advice from someone whose opinion was to be respected; (4) those who did not understand the problem (as shown by not answering or by answering without giving a reasonable reply). The record in Table No. 13 shows that only a small percentage would place father before country in the given situation. Most of those who were not given credit for this question belong to the group which did not understand the problem. Negative results before eighteen do not mean, therefore, that the children before that age are lacking in patriotism but rather that they have not yet developed sufficiently to appreciate this obligation.

11. *A certain young man of great influence in the community is unfortunately addicted to drink. In a conversation with a person in authority you are asked whether you have noticed any signs of over-indulgence in this young man. You promised never to let anyone else know about the matter and then gave your information to the one in authority. A couple of days later, you are asked the same question by an intimate friend who thinks he has noticed something wrong with this young man of influence. In asking the question your friend has made it so pointed that the answer must be "Yes" or "No."*

What should your answer be?......... Why?........

Problem No. 11 is, it seems on close examination, rather a dilemma. There are three principles involved, (1) sacredness of truth, (2) charity in protecting another's reputation, (3) obligation to keep a promise. The problem is not as clearly worded as it might have been—it would have been better had it read:

"In a conversation with a person in authority you are asked to make a promise that you will never discuss with any other person a personal matter about which he wishes to consult you. You give your promise and are asked frankly whether you have ever noticed any signs of over-indulgence in this young man, etc."

The problem could be summarily solved if the subject were allowed to evade the answer. Then some such response as "I cannot answer," or "I don't care to discuss this man's affairs" would suffice. We could feel free in conscience, that whatever inference our interrogator might draw from such a non-committal reply was not a matter for our concern. However, the question as asked gives us a choice of "Yes" or "No." Belief in the justifiability of "mental reservations" would offer one solution of the problem. The answer would then be "No" with the mental reservation that "It is not a matter on which you have a right to information from me." However, the theory of "mental reservations" is not held by moralists, universally, at present. To those men who do not hold this theory "Yes" is the only possible answer to the question, because "No" would be a lie and a lie is not permitted even though good may come of it—as saving the man's character, or, keeping a promise. Because of the controversy of opinion in this case, no absolute answer is possible, and it will be necessary to get the percentage of answers in each of the three groups: (1) tell the truth, (2) tell a lie, (3) say "No" with a mental reservation.

On examination of the papers it was found that the third group was practically non-existent. The answer "Yes" or "No" to groups 1 and 2 respectively were not recorded as principles unless the *why* was answered. The *why* brought out the conflict the subject felt between the duty to tell the truth and the duty to keep a promise. The question is not understood by the average child before the age of 14, and among those below this age who do understand it, the tendency is to tell a lie and keep their promise. This tendency becomes more pronounced as the child grows older. At year 18, 90 percent of the subjects understand the question. Of these, 69 percent solve the problem by lying while 21 percent solve it by telling the truth. These figures are very enlightening when we consider that they represent the relative value of keeping one's word when it has been pledged, and of telling the truth, in the mind of the young American. The numbers and percentages for each group at the various ages are given below:

Age	9	10	11	12	13	14	15	16	17	18	Ad.
	4	33	63	89	126	140	100	58	23	9	5
Tell Truth (yes)	28.4	29.7	28.5	25.1	28.4	29.5	24.3	21.9	17.7	21.4	23.8
	3	30	83	135	187	238	229	154	79	29	10
Tell a Lie (no)	21.4	29.7	37.5	38.1	42.1	50.2	55.6	58.2	60.8	69.0	47.6

12. *In recent years it has frequently happened that white women have been attacked by negroes and greatly injured. The negro, on being arrested, has many times been seized by a mob and put to death. What moral right has the mob in such a case? Explain your answer fully.*

The theme involved in this question is one which has of late come before the public very frequently. The answer which the subject gives will show how far his training has gone along the line of a most sacred right and duty belonging to the State—that of capital punishment. The belief in this principle is essential to the safety of our Republic, and therefore should be stressed, wisely, in Civil Government courses throughout the land. This principle lays down the exclusive right of the State to administer capital punishment, and the subject, in order to receive credit must state this principle in some form. No private individual nor group of persons has the right to take judicial procedure into his own hands, deciding the guilt of the criminal and administering the death sentence whether humanely or with cruelty.

Table No. 14 reveals the fact that the solution of the problem in conformity to these principles is beyond even the average adult. This is due to the emotional resonance called into play in a situation such as that presented. In the face of the "race question" even our most sacred and necessary institutions fall the prey of human passions. The answers received are classified in Table No. 15 under the headings:

(1) The mob has the right to lynch the negro.
(2) The State alone has the right to punish the negro, and
(3) Lack of understanding.

A fourth group which may overlap the others gives the number of answers showing appreciation of the sex element involved. Even at the higher ages there is little appreciation of a sex factor in this problem. The number of cases which definitely sup-

TABLE NO. 14

Age / Sex / (School)	9 B	9 G	10 B	10 G	11 B	11 G	12 B	12 G	13 B	13 G	14 B	14 G	15 B	15 G	16 B	16 G	17 B	17 G	18 B	18 G	Ad. B	Ad. G
S. Public											2	5	3	4	1	1		0				
											40.0	81.4	100.0	66.7	50.0	33.3		0				
P. Public	0	0	4	2	10	8	19	13	24	7	13	4	4	1	3	0						
	.0	.0	23.5	13.3	29.4	22.2	37.2	28.2	41.3	19.5	40.7	16.0	12.5	14.3	50.0	.0						
G. Public			0	1	7	1	18	12	22	12	23	22	20	10	17	9	5	3	3	0	2	0
			.0	25.0	58.3	5.9	47.3	28.6	44.9	21.0	46.9	47.8	54.0	30.3	56.1	41.0	45.5	37.5	42.9	.0	40.0	.0
Catholic	0	0	4	1	5	8	22	19	52	36	64	56	71	74	37	49	23	33	5	12	1	8
	.0	.0	12.9	2.9	10.0	11.9	28.2	20.7	71.2	36.4	43.5	34.2	50.4	39.2	48.1	38.7	56.1	48.5	55.6	46.2	50.0	80.0
Total for all schools	0	0	8	4	22	17	59	44	98	55	102	87	98	89	47	70	28	36	8	12	3	8
	.0	.0	15.4	7.4	22.9	14.1	35.4	24.7	42.2	27.2	44.1	35.7	48.3	37.7	45.6	42.0	52.9	46.1	50.0	80.0	42.9	81.8
Total for both sexes	0		12		39		103		153		189		187		117		64		20		11	
	.0		11.3		18.6		29.8		35.2		39.7		41.5		43.4		49.6		66.0		61.2	

TABLE NO. 15

Age / Sex / (Principle)	9 B	9 G	10 B	10 G	11 B	11 G	12 B	12 G	13 B	13 G	14 B	14 G	15 B	15 G	16 B	16 G	17 B	17 G	18 B	18 G	Ad. B	Ad. G
Mob has the right	1	1	15	12	25	32	44	41	71	68	75	106	56	70	38	55	12	24	7	6	1	2
	12.5	25.0	28.8	22.2	26.0	26.6	26.4	34.9	30.7	33.7	33.0	44.7	28.0	30.5	33.4	36.3	22.7	31.7	43.8	22.2	14.2	18.2
Sexual appreciation	0	0	0	1	1	0	6	4	10	4	16	7	13	14	12	16	6	8	1	2	0	0
	.0	.0	.0	1.9	1.0	.0	3.6	3.4	4.3	2.0	7.0	3.0	6.5	6.1	10.6	10.6	11.3	10.6	6.3	7.4	.0	.0
Did not understand question	6	3	28	31	35	48	25	76	51	78	46	57	36	61	15	33	9	14	0	7	1	1
	75.0	75.0	53.8	57.4	36.4	39.8	31.2	64.6	22.0	38.6	20.2	24.1	18.0	26.5	13.2	21.8	17.0	18.5	0	25.9	14.2	9.1
Sovereign power in State alone	0	0	8	4	22	17	59	44	98	55	102	87	98	89	47	70	28	36	8	12	3	8
	.0	.0	15.4	7.4	22.9	14.1	35.4	24.7	42.2	27.2	44.1	35.7	48.3	37.7	45.6	42.0	52.9	46.1	50.0	80.0	42.9	81.8

port mob-rule is surprisingly large—indeed, one would hardly expect to have the adherents of this principle increase in number with age and yet that is what happens. They increase at about the same rate as belief in the exclusive right of the State to judge such a case, although the percentages, are somewhat lower.

The results of this problem point to the need of further training in Civics in our schools. Furthermore, this training should not be theoretical and therefore lacking in interest to the normal boy or girl, but rather it should be of a practical nature, teaching them to solve concrete problems similar to the one presented here. Thorough training of this nature would go far towards settling, in the course of a generation, many of the problems which are fast becoming acute, and which will prove a serious menace to our civilization unless solved.

13. *Imagine the following situation:*

A man and his young lady friend of city A went to a show in another city B, which is situated across the bay from city A. They spent the evening pleasantly but missed the last boat for B. The only way of getting home from B to A is by automobile, a journey of six hours. If they went by automobile from B to A they would not arrive home any sooner than if they waited for the first boat in the morning. They do not know anyone in B. The young man has plenty of money with him, and there is a telephone connection. What should be done?............

This problem has been taken with some slight modification from Webb,[1] "Character and Intelligence." The purpose of presenting such a situation is to find out at what age children begin to appreciate the presence of a definite sexual element in a situation. Any realization that it is necessary for the young couple to separate for the night, discloses the presence of this appreciation, and is given credit. A solution pointing out the obligation that the young people forsee and counteract all suspicions that might arise later, thus protecting the girl from any reasonable criticism of her conduct, shows a highly developed appreciation of the conventionalities society has created to govern sex. Such an answer as "Telephone and do what mother says," was not

[1] Webb, E. "Character and Intelligence," 1915, p. 21.

credited because it did not offer any solution to the vital part of the problem.

Table No. 16 seems to show that only a small percentage of average adults appreciate the situation in hand. In solving the problem, which it was evident from their answers they understood, no mention was made of the advisability of separating for the night. Possibly this is implied in such an answer as "Go to a good hotel," or "Take a room for the night." It is quite certain, however, that the sexual appreciation is not dominant in the mind of such an indivivdual, otherwise so vital a part of the plans as the safeguarding of the young lady's reputation could be hardly ignored. A record was made of the number of cases of sexual appreciation where the solution was inadequate, of the inadequate solutions as a whole, and of the number not comprehending the situation at the various ages. This data is presented in Table No. 17.

14. *Many people hold this theory for their philosophy of life; "I shall live my life in whatever way I may obtain the greatest possible happiness." Do you agree with this theory?........ Why?........*

There is a young lady who married a man not for love but for material reasons. After she has been married a few years, there comes into her life a man who seemed destined to make her happy. As love for her "soul's mate" increases, life with her husband becomes more and more unbearable. Has this woman a right to rectify her earlier mistake and attain her life's happiness? Why? ....

A fully correct answer to the first part of this question involves the perception of a distinction between pleasure and happiness made only at the zenith of Greek Philosophy by Aristotle. As a matter of fact, however, the actual distinction brought out in the minds of the children was the distinction between egoism and altruism. The age at which altruism makes its appearance in the child's mind—whether by natural development or by instruction—can be determined from these answers. Any answer was regarded as correct that expressed in some way that the concept of happiness must be limited, *e.g.*, that the welfare of others should be considered. Agreement or disagreement with this theory was regarded as a matter of indifference.

The second part of this question will bring out various answers

TABLE NO. 16

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public					0 .0						0 .0											
P. Public	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 0	2 3.9	3 8.1	2 6.9	0 .0	0 .0	0 .0	0 .0	1 50.0						
G. Public			0 .0	0 .0	1 8.3	0 .0	2 5.7	2 5.1	25 52.0	9 16.1	4 8.9	4 8.2	7 20.0	3 8.8	4 36.4	8 13.8	2 16.7	8 100.0	3 42.9	0 .0	1 25.0	0 .0
Catholic	0 .0	0 .0	0 .0	0 .0	0 1.1	0 .0	0 .0	1 1.1	11 8.9	13 12.0	23 26.3	19 11.4	23 16.6	32 17.0	20 26.4	35 27.7	24 57.1	17 24.7	1 11.1	9 34.7	2 100.0	2 20.0
Total for all schools	0 .0	0 .0	0 .0	0 .0	1 1.1	0 .0	2 1.3	3 1.8	38 17.0	25 10.0	29 13.1	23 10.0	30 15.6	35 15.4	26 26.5	42 26.0	26 47.3	25 32.5	4 25.0	9 33.3	3 50.0	2 18.2
Total for both sexes	0 .0		0 .0		1 0.5		5 1.6		63 14.9		52 11.5		65 15.4		68 26.1		51 38.8		13 30.3		5 29.4	

TABLE NO. 17

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (Principle)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
Sexual appreciation	0 .0	0 .0	0 .0	0 .0	2 2.2	0 .0	0 .0	2 1.2	3 1.3	38 19.0	1 0.5	1 0.4	7 3.6	6 2.6	3 2.8	13 8.6	1 1.8	3 3.9	0 .0	2 7.4	0 .0	0 .0
No adequate solution	7 100.0	5 100.0	40 87.0	33 63.4	73 81.8	80 74.4	135 89.1	142 82.4	175 78.3	133 66.5	185 84.0	193 82.8	151 78.5	183 80.5	77 70.8	91 60.1	27 49.1	61 79.3	13 81.3	16 59.2	3 50.0	8 72.7
Did not understand question	0 .0	0 .0	6 13.0	12 23.0	5 5.6	8 7.4	9 5.9	18 10.4	8 3.6	10 5.0	5 2.3	8 3.5	6 3.1	4 1.8	2 1.8	2 1.3	0 .0	1 1.3	0 .0	0 .0	0 .0	0 .0
Adequate solution	0 .0	0 .0	0 .0	0 .0	1 1.1	0 .0	2 1.3	3 1.8	38 17.0	25 10.0	29 13.1	23 10.0	30 15.6	35 15.4	26 26.5	42 26.0	26 47.3	25 32.5	4 25.0	9 33.3	3 50.0	2 18.2

according to the child's previous training. A correct answer, however, should recognize that marriage is a stable condition and once entered upon should not be broken merely because one party has experienced a transfer of affections. Once a contract has been made of such a serious nature, involving not only one's own personal happiness but also that of others, the one who experiences a transfer of affections has a duty to handle this inner problem of his or her own mind so as not to interfere with the stability of a promise made for better or worse until death.

The percentages as presented in Table No. 18 represent the number of cases answering both parts of this question correctly, *e.g.,* limiting their agreement or disagreeing with part one, and recognizing the indissolubility of the marriage-tie in part two. The average adult is able to answer both parts correctly according to our Table.

The percentages for the various types of answers are given in Table No. 19. These answers were classified under the headings:

I. Agree with the theory (as presented in part one).

II. Disagree with or limit the theory (in both cases the subject was credited only if the "why" was answered).

III. Woman may not rectify her mistake because marriage is indissoluble.

IV. Woman may not rectify her mistake for emotional reasons, *e.g.,* she should not have married for money.

V. Woman may rectify her mistake (divorce admitted or implied).

The average child appreciates the altruism of the principle in part one at about 14. This appreciation continues to increase as he matures.

The recognition of marriage as an indissoluble institution by the average person comes in the adult period (Table No. 19). At this age, however, the number of cases is small and we can only be sceptical of the response we would receive, had we a large, rep-

resentative group of adults. The percentages are raised very considerably in the cases at hand by the fact that a large number of Catholic children are considered with the public school children, and the Catholic teaching on the question of the permanence of marriage permits no doubt in the minds of her adherents.

It is interesting and quite significant that at, and below, the age of fourteen the majority of children who understand the situation are convinced that the woman has no right "to attain her life's happiness," yet fifty percent or more of these children give an emotional reason for thinking so. In other words, they base their decision on emotions and not on a principle of right and wrong. At fifteen the percentage of cases basing their decision on principle is considerably higher than the number reaching a decision from emotion. The more mature years are marked, of course, by the ability of the individual to decide a question according to principles involved without regard for his emotional reaction.

15. *A boy was adopted into a fairly wealthy family which consisted of a doctor, his wife, and their son. When the adopted son, who was somewhat older than the son, finished high school he desired to enter college. The doctor, through some reverses, had not sufficient funds to send him to college and also to provide for his own boy's education. Thus the adopted son, who was very noble-minded, insisted that the younger boy should have the preference. When this boy was sent to college he proved himself dissipated and a spendthrift. One day he demanded money from his father, and, on being refused, flew into a passion and struck him. The blow caused him to reel backward, and falling he struck his head against the sharp corner of a bookcase. Death was instantaneous. The adopted son who was just entering the room saw all that happened. The son realizing what he had done, and foreseeing the effect the news would have on his mother, begged his adopted brother to assume the guilt. In gratitude for the care and affection that he had received from his foster parents, and hoping to spare his foster mother the knowledge that her son was a murderer, he assumed the guilt.*

Is he justified in his action?........ Why?........

We meet constantly the theme of this incident in the modern short story and in the sentimental "movie." It is frequently used as a development of the scriptural text "Greater love than this no man hath, that a man lay down his life for his

TABLE NO. 18

Age Sex (School)	9 B	9 G	10 B	10 G	11 B	11 G	12 B	12 G	13 B	13 G	14 B	14 G	15 B	15 G	16 B	16 G	17 B	17 G	18 B	18 G	Ad. B	Ad. G
S. Public				1 50.0							0 .0			0 .0								
P. Public	0 .0	0 .0	3 30.0	0 .0	1 4.4	1 4.6	8 19.5	3 7.9	8 14.8	0 .0	3 11.1	2 9.5	1 6.3	1 16.7	0 .0	0 .0						
G. Public			3 75.0	1 25.0	0 .0	1 6.3	2 5.6	3 7.5	6 12.5	2 3.6	10 21.7	3 7.3	10 28.6	4 28.6	5 17.9	5 22.8	3 33.3	2 25.0	2 33.3	0 .0	2 50.0	1 100.0
Catholic	0 .0	1 33.3	2 6.6	1 3.1	9 20.4	9 13.4	22 30.6	26 29.7	56 45.9	46 43.2	56 39.8	54 32.4	77 56.2	112 60.5	51 67.8	89 70.3	31 73.7	44 63.8	8 88.9	18 69.3	1 50.0	8 88.9
Total for all schools	0 .0	1 25.0	8 18.2	3 6.1	10 12.7	11 19.3	32 21.8	32 19.7	70 32.8	48 24.7	83 38.6	56 24.4	88 46.6	117 56.7	55 56.7	95 58.9	34 65.3	46 59.8	10 66.7	18 66.6	3 50.0	9 90.0
Total for both sexes	1 11.1		11 11.9		21 15.6		64 20.5		118 28.7		139 31.1		205 51.9		150 57.9		80 62.8		28 66.6		12 75.0	

TABLE NO. 19

Age Sex (Principle)	9 B	9 G	10 B	10 G	11 B	11 G	12 B	12 G	13 B	13 G	14 B	14 G	15 B	15 G	16 B	16 G	17 B	17 G	18 B	18 G	Ad. B	Ad. G
I	0 .0	0 .0	12 27.2	9 19.2	19 27.2	22 22.7	27 18.4	34 20.4	41 20.2	32 16.3	27 12.6	32 14.0	23 12.2	17 83.0	5 4.7	8 5.4	2 3.8	2 2.6	0 .0	0 .0	0 .0	1 10.0
II	1 20.0	0 .0	9 20.4	9 19.2	34 48.6	26 26.8	61 41.5	87 52.2	129 63.5	110 56.1	149 69.7	173 75.0	141 74.7	191 93.2	84 78.1	115 77.1	47 90.2	72 93.6	10 66.7	25 92.5	5 83.3	9 90.0
III	0 .0	0 .0	8 18.2	4 8.5	20 28.6	21 21.6	45 30.6	35 21.0	79 38.9	62 31.6	81 37.9	79 34.4	90 47.7	120 58.6	62 57.7	103 69.0	32 61.4	50 65.0	10 66.7	18 66.6	3 50.0	9 90.0
IV	3 60.0	0 .0	10 22.7	7 14.9	14 20.0	22 22.7	31 21.1	63 37.8	60 29.5	76 38.8	58 27.1	99 43.2	49 26.0	68 33.2	19 17.8	25 16.8	12 23.0	19 24.7	2 13.3	6 22.2	3 50.0	2 20.0
V	0 .0	0 .0	8 18.2	6 12.8	12 17.2	12 12.4	32 21.8	22 13.2	33 16.2	21 10.7	47 22.0	36 15.7	21 11.1	21 10.2	17 15.8	9 6.0	4 7.7	7 9.1	4 26.7	2 7.4	1 16.7	0 .0

friends."[2] Could there be any grosser misinterpretation of a scriptural passage than this? It is fulfillment by means of a living lie. By some such sentimental appeal as this one to the emotion of gratitude, the public is led to believe that a lie, even perjury, is justifiable and oftentimes noble. There is only one possible answer to this question and it is "No." The *Why,* if the subject is to be credited, must disclose a realization of the principle involved and not a mere emotional reaction.

Table No. 20 discloses the fact that even in adult years only a very small percentage of cases see through the mass of emotional reactions stirred up by the situation presented, and recognize the lie involved.

The wrong answers were analyzed according to the following schema with the results presented in Table No. 21. The answers were divided into two groups and each of these groups was sub-divided.

Group I. Action is justifiable.

1. For love of his foster-mother.

2. Other emotional reaction, *e.g.,* gratitude to the son, to save the family name, etc.

Group II. The action is not justifiable.

1. Justice requires that the murderer suffer for his crime.

2. Emotional reasons, *e.g.,* the son is unworthy of such a sacrifice, he would be a better protector of his foster-mother than her son, the son may kill someone else later, etc.

No account was taken in this analysis of those whose reply showed that they did not understand the problem.

16. *In most of our large cities there are theatres known as "Burlesque Shows." The main performances are open to men only. What is your opinion of this restriction?*........

The last problem presented in the series brings out (1) what attitude the subject takes toward the present-day double standard of morality, and (2) the method he would suggest of coping with

[2] St. John, xv. 13.

TABLE NO. 20

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public											0 .0	0 0	0 .0	0 .0	0 .0	1 33.3		0 .0				
P. Public	0 .0		0 .0	0 .0	0 .0	0 .0	4 .0	4 12.9	4 9.8	1 3.2	3 13.1	1 6.7	1 9.1	0 .0	0 .0	1 50.0						
G. Public			0 .0	0 .0	0 .0	0 .0	4 14.8	2 6.1	3 6.4	9 16.7	1 2.5	2 6.6	1 2.9	3 9.9	3 11.2	0 .0	1 9.1	2 28.6	1 16.3	0 .0	1 25.0	0 .0
Catholic	0 .0	1 50.0	1 3.7	2 6.9	4 9.7	2 3.6	6 20.0	7 8.4	9 8.0	11 10.7	8 6.1	19 12.0	7 5.3	25 13.8	2 74.7	23 18.2	3 7.5	8 11.9	2 22.2	6 23.1	0 .0	1 11.1
Total for all schools	0 .0	1 50.0	1 2.5	2 5.1	4 5.6	2 2.3	10 8.2	13 8.7	16 8.0	21 11.0	12 6.0	22 10.3	9 5.1	28 12.5	2 2.1	30 19.1	4 7.8	10 13.5	3 20.0	6 23.1	1 16.7	1 11.1
Total for both sexes	1 14.3		3 3.8		6 2.7		23 8.5		37 9.5		34 8.2		37 9.2		32 12.5		14 11.2		9 22.0		2 13.3	

TABLE NO. 21

Principle		9	10	11	12	13	14	15	16	17	18	Ad.
Action Justifiable	Love of Mother	0 .0	3 3.8	9 5.8	34 12.1	39 10.1	47 11.8	53 13.4	18 7.1	21 16.8	6 14.6	0 .0
	Emotional Reasons	0 0	5 6.4	9 5.8	16 5.7	37 9.5	42 10.5	32 8.1	28 11.0	5 4.0	5 12.2	1 6.8
Action not Justifiable	Sense of Justice	2 28.6	9 11.4	27 17.3	42 15.0	78 20.1	104 26.0	89 22.5	53 20.8	24 19.2	6 14.6	11 73.4
	Emotional Reasons	0 .0	3 3.8	19 12.2	32 11.4	74 19.1	106 26.5	89 22.5	86 33.8	48 38.4	12 29.3	1 6.8
	Involving a Lie	1 14.3	3 3.8	6 3.8	23 8.2	37 9.5	34 8.2	37 9.5	32 12.5	14 11.2	9 22.0	2 13.3

the existing situation. The realization that such a double standard of morality exists again throws light on the subject's appreciation of sex problems. His attitude toward existing conditions will show whether his standard of morals is higher or lower than that of society which tolerates such theatres. No attempt was made to score the answers to this question as correct or incorrect. Principles disclosed were, however, of particular interest.

In Table No. 22 are presented the number of cases and percentages giving answers which were classified under these four forms. The restriction proves that:

I. They demoralize men.

II. They should be abolished, and,

III. The restriction is a good one in that it protects the morality of women and children.

IV. If they are not fit for women they are not fit for men.

As no other principles except the four mentioned above presented themselves in the answers to this question the sum of the cases giving each of these replies is the number answering correctly. We find that the average child of 13 disapproves of these theatres and for some logical reason. In all the papers considered only two persons—boys of 14—approved of these performances. A number of replies were non-committal or showed lack of comprehension of the problem. No record was made of these.

An interesting fact was gleaned from the answers of several boys, ranging from 15-18 in one of the school groups. These boys condemned burlesque shows in very decided terms and gave as their reason that managers did not adhere strictly to regulations and frequently boys under 16 gained admittance and this was the beginning of their moral downfall.

The very fact, it would seem, that such shows are recognized by growing children as morally undesirable should argue strongly for their abolition.

All the problems embodied in the above stories represent possible experiences although they are, in most cases, exaggerated considerably. As individual members of society, our solution of the problems indicates society's general tone of morality, today.

TABLE NO. 22

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (Principle)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
I	0	0	9	2	14	21	33	53	68	59	66	88	49	109	31	53	17	27	8	12	1	1
	.0	.0	16.1	5.1	28.0	33.4	32.7	40.8	38.8	38.4	37.6	41.0	28.9	51.4	34.1	40.3	36.2	36.5	57.1	48.0	25.0	16.7
II	0	0	8	1	4	3	8	13	21	20	23	16	18	19	6	6	3	2	1	1	1	0
	.0	.0	14.3	2.6	8.0	4.8	7.9	10.0	12.0	13.0	13.1	7.6	10.6	9.0	6.6	4.6	6.4	2.7	7.1	4.0	25.0	.0
III	0	0	5	2	4	3	8	8	10	12	17	11	19	10	13	26	7	12	2	3	1	3
	.0	.0	9.0	5.1	8.0	4.8	7.9	6.2	5.7	7.8	9.7	5.2	11.2	4.7	14.3	19.8	14.9	16.2	14.3	12.0	25.0	50.0
IV	0	0	3	5	10	11	20	23	31	27	39	29	28	22	26	26	15	26	2	8	1	1
	.0	.0	5.4	12.8	20.0	17.5	19.8	17.7	17.7	17.6	22.2	13.7	16.5	10.4	28.6	19.8	32.0	35.1	14.3	32.0	25.0	16.7
Total of correct answers	0	0	25	10	32	38	69	97	130	119	145	144	114	160	76	85	42	67	13	24	4	5
	.0	.0	44.6	25.6	64.0	60.4	68.3	74.7	74.1	77.4	82.7	68.0	67.3	75.5	83.6	84.6	89.5	90.5	92.9	96.0	100.0	83.3

On the way in which our children are taught to deal with these and similar problems depends the morality of society tomorrow. The importance of educating the children along lines of correct moral thinking cannot be overestimated. The results obtained through the examination of about 4,000 school children on these questions will throw some light, it is hoped, on the moral problems of childhood, the ideals and principles of morality to which the child's mind is sensitive at various ages and so enable us to attempt a rational system of moral education.

CHAPTER V

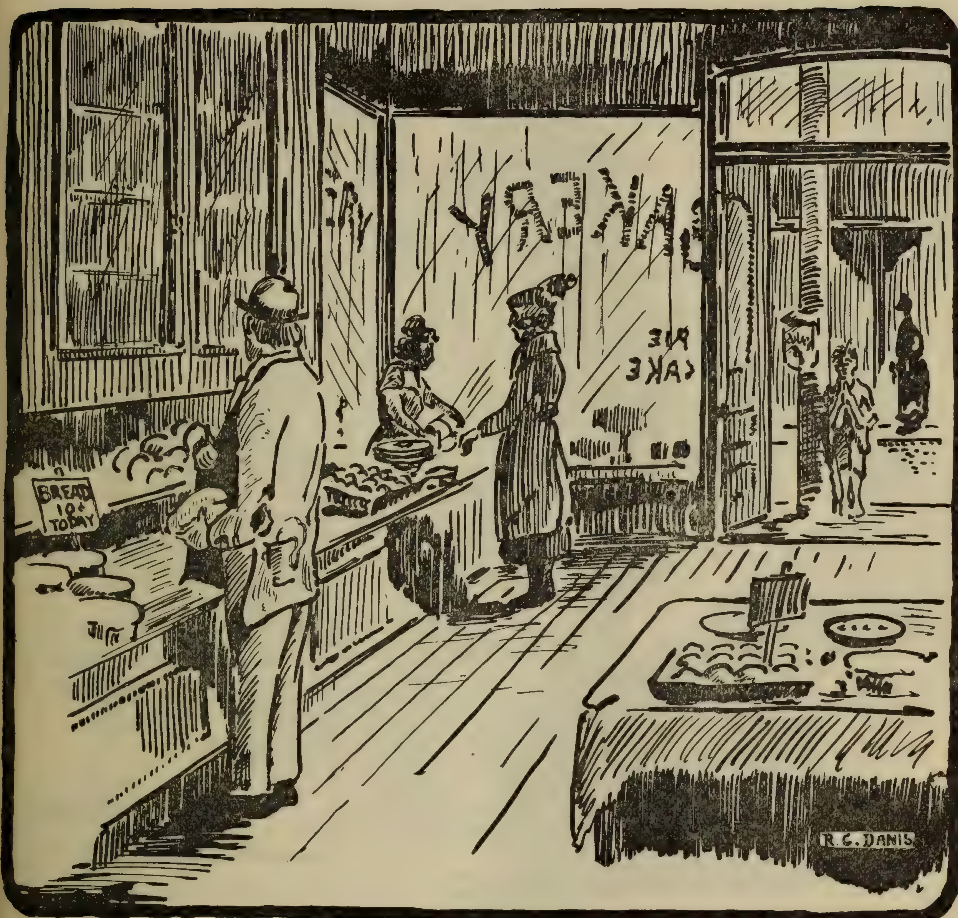
Interpretation of the Moral Problems presented by means of Pictures

The third division of the tests consists of a series of pictures. In the first experiment with the tests the pictures were merely pencil sketches which were held before the class for their interpretation. When the tests were given in the revised form the pictures used had the same themes, but were redrawn and printed, so that each subject could have a complete set of pictures to work with. A set consists of eight pictures which are presented to the child with the question, *What does this picture mean? What is this picture about?*, or *What story does the picture tell?* It is necessary to explain to the class that all the views on one card are part of a single theme.

Picture No. 1 shows a beggar stealing a loaf of bread from a bakery while his hungry child looks in from without. It represents a possibly justifiable act of getting food without paying for it.

The children from the semi-rural district, G. Public, are much more capable of interpreting the picture, if we may judge from the results given in Table No. 23, than any of the other groups. In order to have the answer credited it was merely necessary to recognize the act portrayed as theft, and not to interpret it as a possibly justifiable act. A second interpretation—that of a starving child watching rich people buy food—was given by many children. This answer was not given credit.

The value of this picture as a test of moral knowledge is doubtful. Interpretation by 75 percent may be attained by super-adults. However, we are inclined to think that the principle involved is not too difficult for a 15 or 16-year-old child, but rather that the drawing is not sufficiently clear to enable the subject to pick out the action which he is to interpret.



PICTURE NO. 1

PICTURE NO. 2

TABLE NO. 23

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public	0	3	16	9	24	20	30	18	35	14	18	22	12	1	6	3						
	.0	16.7	21.3	13.4	23.3	23.4	27.9	19.6	34.4	20.9	30.4	42.2	38.8	6.3	75.0	60.0						
G. Public			5	8	13	12	24	20	37	36	33	36	26	22	21	18	10	6	9	0	6	2
			71.5	66.7	65.0	52.2	61.4	46.6	68.5	60.1	62.4	59.0	66.6	62.9	67.9	81.9	90.9	85.7	100.0	.0	100.0	100.0
Catholic	0	1	9	6	18	18	29	35	60	54	68	67	81	89	46	62	31	25	8	9	1	0
	.0	25.0	19.9	15.3	29.5	21.4	33.9	34.3	45.6	50.8	45.9	40.2	61.6	46.3	57.5	49.0	74.9	38.5	88.9	34.7	50.0	.0
Total for all schools	0	4	30	23	55	50	83	73	132	104	119	125	119	112	73	83	41	31	17	9	7	2
	.0	18.2	23.7	19.3	29.7	24.5	35.8	30.8	47.5	44.7	44.0	63.9	56.9	45.9	61.3	54.0	74.6	43.1	94.5	36.0	88.9	40.0
Total for both sexes	4		53		105		156		236		244		231		156		72		26		9	
	10.5		21.7		27.3		32.8		46.0		45.1		50.8		57.1		56.9		60.6		69.2	

TABLE NO. 24

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public	1	2	14	5	23	8	15	11	21	7	11	7	8	4	3	2						
	9.1	11.1	18.9	7.3	22.3	8.4	14.0	12.1	22.1	10.3	18.6	13.4	25.8	25.0	37.5	40.0						
G. Public			4	5	8	9	21	23	32	45	27	32	25	21	24	20	9	6	8	0	6	2
			57.2	26.3	40.0	39.2	53.8	52.2	59.2	73.8	51.8	59.2	64.0	60.1	77.5	91.0	81.8	85.7	88.9	.0	100.0	100.0
Catholic	0	1	6	1	15	15	21	25	57	34	67	50	77	64	42	50	33	20	6	8	1	2
	.0	25.0	14.3	2.6	24.2	17.7	27.8	24.8	42.8	31.9	36.2	30.0	53.1	33.3	53.8	39.5	93.1	31.2	66.7	33.3	50.0	66.7
Total for all schools	1	3	24	11	46	32	57	59	110	86	105	89	110	89	69	72	42	26	14	8	7	4
	6.3	13.7	19.4	9.2	24.8	15.7	24.7	25.0	39.1	36.6	39.5	33.2	51.9	36.5	59.3	46.8	76.4	36.7	77.8	33.4	87.5	80.0
Total for both sexes	4		35		78		116		196		194		199		141		68		22		11	
	10.5		14.5		20.1		24.8		38.6		37.8		44.0		52.3		54.7		52.4		84.6	

Picture No. 2 shows a pickpocket in the act of thieving on a crowded street. This typifies wholly unjustifiable appropriation of another's property. No contrast between the two pictures was called for.

In this picture also it was sufficient to mention the act of stealing to receive credit. In practically all cases children recognizing the act termed it "pickpocketing" which proved that in their mind there was no question as to the moral guilt of the thief. The average subject does not interpret this picture correctly before adult age. The results of this test are given in Table No. 24.

No. 3 is made up of two pictures. The first shows two men quarreling at cards; the second shows shooting as a result of the quarrel. It represents unjustifiable taking of the life of another The record of this test is given in Table No. 25. Children at 12 interpret this picture without any difficulty. In order to be counted as correct it was required that the subject not merely recognize that gambling was represented in the one picture and murder in the other, but he must interpret the cause and effect relation between the two.

In No. 4 a pioneer has just shot an Indian who attempted to enter his cabin. It is evident the killing of the Indian is an act of self-defense and therefore justifiable. On the whole, subjects up to the age of 18 had considerable difficulty in interpreting this picture correctly (Table No. 26). Any explanation which gave murder as an act of defense was considered correct. Various subordinate interpretations were received for this picture and have been recorded in Table No. 27. These interpretations were classified as follows:

I. Housecleaning, moving, and other interpretations involving no moral concept.

II. Fire, when mother sacrifices self to save her child.

III. A son threatening to shoot his mother; a cruel husband under the influence of drink.

IV. Eviction because they cannot pay their rent.

V. Men breaking into the house, woman begging robbers to spare the baby; insanity.

None of these answers were credited.

Picture No. 3

The picture is undoubtedly open to severe criticism from an artistic standpoint. It was desired to portray self-defense and hence all items in the picture should help us to see this central theme. In reality, however, the attention of a great number of persons examined, was distracted by the cradle in the foreground and their interpretation centered around the baby they imagined to be in it. Possibly the dramatic pose of the mother saving her child so often portrayed in the "movie" was suggested by the scene and called forth a rather exaggerated, emotional reaction. A possible insight into home conditions of some of the children may be suggested by the responses under interpretation III. Had it been possible by making an investigation of home-conditions in these cases to prove a relationship between the two, the test would have an additional value. However, this was not possible, and we can only conjecture that through free association this relationship may exist.

The theme of No. 5 is presented in three pictures. The first shows the interior of a church, indicating that it is Sunday; the second portrays two boys seriously discussing some project, the church being in the background; the third shows the two boys fishing. Taken as a whole the three pictures tell us that the boys instead of going to church have gone fishing and it must be given this interpretation if the child is to receive credit.

The growth in moral concepts necessary to interpret these pictures is a gradual one through 16. At 17 there is a sudden increase in the number of those who interpret this series of pictures (Table No. 28). This awakening takes place earlier with Catholic than with public school children. This is undoubtedly due to the training the former receive in which a severe moral penalty is threatened if one neglects this duty. They are, therefore, more keenly alive to situations which would lead to a violation of this important duty.

Another group of three pictures is presented in No. 6. A girl is waiting for a boy who has apparently signalled her in some way. The next picture shows the two young people walking together. It is evident from their books that they are on their

Picture No. 4

TABLE NO. 25

Age Sex (School)	9 B	 G	10 B	 G	11 B	 G	12 B	 G	13 B	 G	14 B	 G	15 B	 G	16 B	 G	17 B	 G	18 B	 G	Ad. B	 G
	6	8	60	37	86	69	91	65	85	55	52	44	28	12	8	3						
P. Public	54.5	44.5	79.8	57.0	83.4	71.8	84.6	71.5	89.3	79.7	87.9	86.2	90.4	75.0	100.0	60.0						
			6	8	17	13	35	33	52	55	49	43	31	31	28	18	8	6	7	1	6	2
G. Public			85.7	42.1	85.0	56.6	89.6	74.9	98.3	90.2	92.6	79.6	79.4	86.2	90.4	81.9	72.7	85.7	100.0	100.0	100.0	100.0
	1	1	25	17	40	52	63	86	113	94	144	120	133	179	80	122	41	58	8	22	2	3
Catholic	20.0	33.3	59.5	49.3	64.4	62.4	75.0	86.9	84.8	87.4	93.6	28.9	94.4	93.1	100.0	96.4	79.5	92.2	88.9	91.7	100.0	100.0
Total for	7	9	91	62	143	134	189	184	250	204	245	207	192	222	116	143	49	64	15	23	8	5
all schools	43.8	42.8	73.7	54.6	75.8	66.3	82.2	78.8	88.8	86.1	92.6	90.7	91.0	91.2	97.4	93.0	89.2	91.5	93.8	92.0	100.0	100.0
Total for	16		153		277		373		454		452		414		259		113		38		13	
both sexes	43.2		64.3		70.6		80.2		87.6		91.8		91.4		95.2		90.4		92.7		100.0 .	

TABLE NO. 26

Age Sex (School)	9 B	 G	10 B	 G	11 B	 G	12 B	 G	13 B	 G	14 B	 G	15 B	 G	16 B	 G	17 B	 G	18 B	 G	Ad. B	 G
	3	2	29	11	53	37	58	35	51	23	38	40	13	5	4	5						
P. Public	27.3	11.8	42.1	16.0	52.0	38.5	54.5	38.2	53.6	33.8	64.2	55.6	42.0	31.3	50.0	100.0						
			1	3	8	6	15	13	29	20	33	25	18	15	21	8	8	5	6	1	6	1
G. Public			10.0	42.9	40.0	26.1	38.4	31.7	54.8	39.2	63.4	46.3	45.0	44.1	67.8	36.4	72.7	71.5	85.7	100.0	100.0	50.0
	0	1	10	2	19	20	35	24	86	39	91	70	98	91	56	80	35	33	9	19	1	2
Catholic	.0	33.3	23.8	5.9	30.6	23.8	42.0	24.5	65.4	36.7	59.2	46.2	68.6	47.3	77.8	63.2	81.7	51.5	100.0	79.2	50.0	66.7
Total for	3	3	39	16	80	63	108	72	168	82	162	135	129	111	81	93	43	38	15	20	7	3
all schools	20.0	15.0	31.2	14.6	43.4	31.0	47.1	31.0	59.6	34.9	61.4	46.2	60.6	46.2	72.9	61.8	78.3	53.6	93.8	80.0	87.5	60.0
Total for	6		55		143		180		248		297		240		174		81		35		10	
both sexes	17.2		23.4		37.0		38.9		48.4		53.5		53.0		65.9		64.2		85.4		76.9	

TABLE NO. 27

Principle	I		II		III		IV		V	
Sex	B	G	B	G	B	G	B	G	B	G
	3	10	0	0	0	1	0	0	5	4
9	20.0	50.0	.0	.0	.0	5.0	.0	.0	33.3	20.0
	40	42	4	2	15	8	0	0	15	11
10	36.0	38.2	3.2	1.8	11.9	7.3	.0	.0	11.9	10.0
	26	34	1	1	19	15	0	0	17	26
11	14.0	16.7	0.5	0.5	10.3	7.4	.0	.0	9.2	12.8
	44	58	5	12	22	37	22	1	28	24
12	19.3	25.1	2.2	5.2	9.6	16.0	9.6	0.4	12.3	10.4
	22	34	0	8	32	45	0	1	20	27
13	7.9	14.5	.0	3.4	11.5	19.2	.0	0.4	7.2	11.5
	22	34	2	5	28	31	0	5	11	35
14	8.3	11.7	0.8	1.7	10.6	10.6	.0	1.7	4.2	12.0
	16	29	1	8	34	26	0	3	15	51
15	7.5	12.1	0.5	3.3	16.0	10.8	.0	1.3	7.1	21.3
	3	10	0	4	17	22	0	0	10	16
16	2.7	6.5	.0	2.6	15.3	14.3	.0	.0	9.0	10.4
	1	5	0	3	7	10	0	2	6	9
17	1.8	7.1	.0	4.2	12.7	14.1	.0	2.8	10.9	12.7
	0	1	0	1	1	2	0	1	0	3
18	.0	4.0	.0	4.0	6.3	8.0	.0	4.0	.0	12.0
	1	0	0	0	1	2	0	0	0	0
Ad.	12.5	.0	.0	.0	12.5	40.0	.0	.0	.0	.0

way to or from school. The third picture of the group portrays the boy kissing the girl. As a whole the theme should be considered immature and improper love.

Over 75 percent of the children interpret this picture correctly at the comparative early age of 12. This indicates, no doubt, that the situation is recognized as a possible one by school children entering upon adolescence. It was not required that the child designate the impropriety of such conduct to receive credit; it was considered sufficient that he was able to interpret the situation as a whole as a "love affair." The percentages interpreting the picture in accordance with this standard are given in Table No. 29.

The types of answers are recorded for the various ages in Table No. 30 as follows:

I. Wrong love; flirting; pick-up-acquaintance; immature love (condemned).

II. School children's love (not condemned)

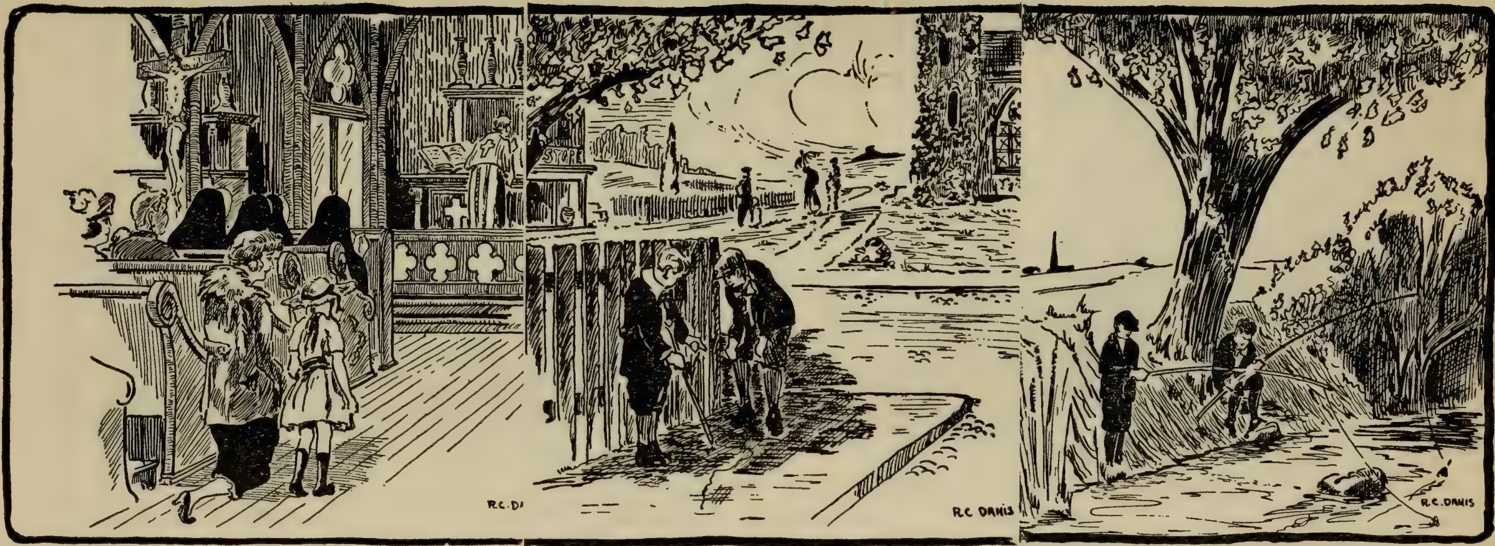
III. Love at first sight; courtship.

TABLE NO. 28

Age Sex (School)	9 B	 G	10 B	 G	11 B	 G	12 B	 G	13 B	 G	14 B	 G	15 B	 G	16 B	 G	17 B	 G	18 B	 G	Ad. B	 G
P. Public	2 18.2	7 38.9	35 49.4	22 32.0	49 48.0	43 44.7	58 54.5	50 54.5	57 60.4	35 55.7	34 57.5	34 65.3	20 64.6	7 43.8	4 57.2	3 60.0						
G. Public			5 45.5	8 42.9	12 60.0	6 26.1	20 51.2	26 60.6	21 40.3	34 55.8	33 64.7	33 62.4	20 51.2	14 41.2	16 51.7	10 45.5	9 90.0	5 71.5	7 100.0	1 100.0	5 83.3	1 50.0
Catholic	1 20.0	2 50.0	11 26.8	15 37.5	23 37.0	34 39.8	43 50.3	48 45.1	85 62.9	67 61.6	91 61.0	108 63.7	105 73.5	154 78.5	62 80.6	95 76.0	36 93.1	55 87.5	8 88.9	20 83.4	2 100.0	3 100.0
Total for all schools	3 17.6	9 41.0	51 41.6	40 34.0	84 46.8	83 40.5	121 52.4	124 51.5	163 57.2	136 58.5	158 61.0	175 63.9	145 68.2	175 71.6	82 71.3	108 71.3	45 83.3	60 92.9	15 93.8	21 84.0	7 87.5	4 80.0
Total for both sexes	12 30.7		91 37.6		167 43.1		245 51.9		299 58.0		333 62.3		320 70.1		190 71.3		105 85.6		36 87.8		11 84.6	

TABLE NO. 29

Age Sex (School)	9 B	 G	10 B	 G	11 B	 G	12 B	 G	13 B	 G	14 B	 G	15 B	 G	16 B	 G	17 B	 G	18 B	 G	Ad. B	 G
P. Public	5 45.5	11 33.4	53 73.7	47 67.2	69 69.7	73 71.4	87 81.8	66 66.6	74 79.9	55 80.9	46 77.7	48 92.2	27 89.1	12 75.0	7 100.0	4 80.0						
G. Public			8 66.6	5 71.5	13 65.0	19 82.7	32 81.9	38 88.5	44 81.4	52 88.9	42 80.6	38 71.8	35 89.6	32 91.5	25 80.8	21 80.9	7 77.8	7 100.0	6 85.7	1 100.0	6 100.0	2 100.0
Catholic	2 50.0	2 50.0	17 43.5	26 66.6	18 29.5	43 51.6	61 70.2	81 77.8	106 78.4	88 81.0	118 79.1	141 83.5	124 88.0	153 79.6	67 93.7	116 94.0	41 93.1	54 85.9	9 100.0	20 83.4	2 100.0	3 100.0
Total for all schools	7 46.7	13 59.2	78 44.5	78 67.1	100 55.6	135 67.5	180 77.8	185 77.7	224 79.5	195 81.9	206 79.3	253 84.0	186 88.9	197 81.2	99 90.1	141 91.7	48 90.7	61 87.2	15 93.3	21 84.0	8 100.0	5 100.0
Total for both sexes	20 54.0		156 53.2		235 61.8		365 77.7		419 80.5		459 82.2		383 84.6		240 90.5		109 88.3		36 87.8		13 100.0	



Picture No. 5

IV. Stages of love from childhood to adult life.

V. Description but no interpretation.

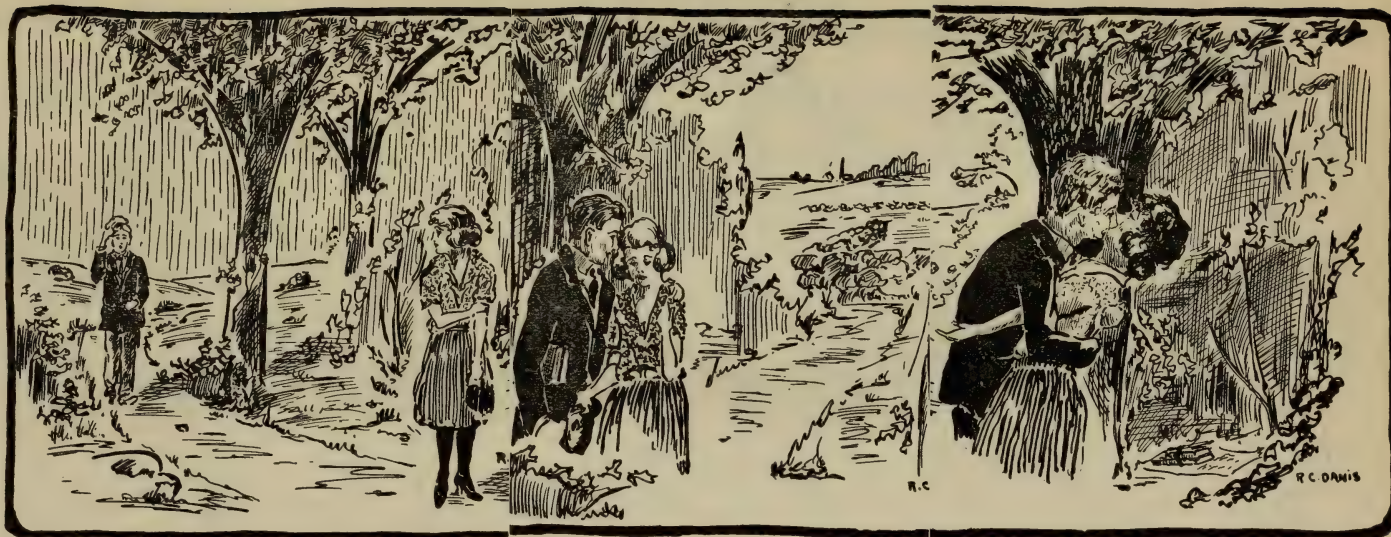
At the age of 12 and after children are, on the whole, keenly aware of the impropriety of the act portrayed. As they near maturity the consciousness that such actions are wrong is developed more and more.

The answers of boys and girls in this situation were filled with the popular tendency to hold the girl responsible. Boys admit freely that the boy was the aggressor—*e.g.*, "He is taking advantage of that girl"—but they add some further remark as "She should not allow it," or, "She should be more careful about where she goes and with whom." Even those interpretations, which considered the girl as being attacked, asserted that she should not have walked in the woods alone. These answers show that the child entering upon adolescence is conscious of the dangers lurking behind such an apparently innocent escapade as the love of school children.

In No. 7 three pictures again are used to represent the theme. The first portrays an apparently happy family at the breakfast table. The husband is then shown leaving for work, his wife and daughter waving goodby to him from the porch. The last drawing shows the man in a cabaret with another woman—decidedly a woman of the underworld.

Answers were not regarded as correct unless they expressed in some way the existence of marital infidelity, although it was not required that the infidelity be attributed to the husband. This is found to be a test for adult years. The percentages interpreting this picture correctly are recorded in Table No. 31.

A record of the person charged with infidelity is given below. The tendency is for more persons at all ages except at 9 and adult age, to consider the wife false rather than the husband. This is an interesting phenomenon when we consider that the picture portrays very clearly that it is the man who is unfaithful. We may assume that children are reading into this picture ideas already formed in their minds. In how far may we attribute this attitude of mind to the impressions children receive in the "movie"?



Picture No. 6

Picture No. 7

To have 55 percent of the children at 13 years interpret this picture correctly, demonstrating beyond doubt that they understand what marital infidelity is, points to a precocious development along these lines which is probably due to information imparted by moving picture shows.

Age	9	10	11	12	13	14	15	16	17	18	Ad.
	4	21	42	90	88	127	126	58	42	15	7
Man False	**11.1**	**8.9**	**10.0**	**19.4**	**17.2**	**24.1**	**33.0**	**24.4**	**33.6**	**37.5**	**50.0**
	5	27	67	116	166	171	179	103	61	16	2
Woman False	**13.9**	**11.4**	**16.0**	**24.9**	**32.4**	**32.5**	**46.9**	**43.3**	**48.8**	**40.0**	**14.3**

TABLE NO. 30

(Principle)	I		II		III		IV		V	
Sex	B	G	B	G	B	G	B	G	B	G
Age	2	5	3	3	5	5	1	0	3	6
9	**13.3**	**22.8**	**20.0**	**13.7**	**33.4**	**22.8**	**6.7**	**.0**	**20.0**	**27.3**
	29	51	21	7	34	20	0	2	31	25
10	**16.5**	**43.9**	**12.0**	**6.0**	**19.4**	**17.2**	**.0**	**1.7**	**17.7**	**21.5**
	27	52	16	18	43	40	8	7	44	41
11	**15.0**	**26.0**	**8.9**	**9.0**	**23.9**	**20.0**	**4.4**	**3.5**	**22.8**	**20 5**
	66	94	23	25	79	63	13	10	36	25
12	**28.5**	**39.5**	**9.9**	**10.5**	**34.1**	**26.5**	**5.6**	**4.2**	**15.6**	**10.5**
	91	106	33	17	86	66	7	9	31	20
13	**32.3**	**44.5**	**11.7**	**7.1**	**30.5**	**27.7**	**2.5**	**3.8**	**11.0**	**8.4**
	103	119	32	45	99	60	9	11	26	20
14	**39.7**	**39.5**	**12.3**	**14.9**	**38.1**	**19.9**	**3.4**	**3.6**	**10.0**	**6.6**
	106	99	23	50	51	42	4	15	20	17
15	**50.7**	**40.8**	**11.0**	**20.6**	**24.4**	**17.3**	**1.9**	**6.2**	**9.6**	**7.0**
	56	72	17	23	21	24	5	13	3	6
16	**51.0**	**46.8**	**15.5**	**15.6**	**19.1**	**16.3**	**4.6**	**9.1**	**2.7**	**3.9**
	24	38	5	8	18	10	2	8	2	3
17	**45.4**	**54.3**	**9.5**	**11.4**	**34.0**	**14.3**	**3.8**	**11.4**	**3.8**	**4.3**
	10	5	2	7	5	6	0	4	0	1
18	**62.5**	**20.0**	**12.5**	**28.0**	**31.3**	**24.0**	**.0**	**16.0**	**.0**	**4.0**
	3	2	1	1	4	3	0	0	0	0
Ad.	**37.5**	**40.0**	**12.5**	**20.0**	**50.0**	**60.0**	**.0**	**.0**	**.0**	**.0**

No. 8 was intended to represent gossip. Two girls are busily engaged discussing something "terrible," without being aware that the subject of their conversation is listening though hidden from their view by a palm. This picture may also be interpreted as "eavesdropping" or "jealousy." Credit was given for any of these answers.

The average child of 15 is able to interpret this picture according to the data presented in Table No. 32. In all, seven different

Picture No. 8

TABLE NO. 31

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	3	6	22	12	38	39	51	36	45	41	29	24	16	5	4	2						
P. Public	30.0	33.4	31.9	17.2	38.8	41.3	48.0	40.0	48.6	60.3	49.0	56.1	52.8	31.3	57.2	40.0						
			3	2	10	5	18	25	29	26	39	31	23	21	15	9	7	4	6	0	6	2
G. Public			25.0	28.6	50.0	21.8	46.1	58.3	53.2	42.6	55.7	62.0	46.9	61.7	48.5	34.7	77.8	44.4	85.7	.0	100.0	100.0
	0	1	7	7	16	25	40	39	78	62	83	94	98	126	55	87	32	47	6	15	2	2
Catholic	.0	25.0	43.5	66.6	26.7	31.3	46.8	38.2	58.5	60.8	56.4	56.4	69.6	65.5	71.5	70.3	93.3	73.3	66.6	62.6	100.0	100.0
Total for	3	7	32	21	64	69	109	100	152	129	141	149	137	152	74	98	39	51	12	15	8	8
all schools	21.4	58.3	26.2	18.3	35.8	35.2	47.3	42.6	54.4	56.0	54.6	67.6	65.2	62.6	64.4	63.7	73.7	71.9	75.0	60.0	100.0	100.0
Total for	10		53		133		209		281		290		289		172		90		27		16	
both sexes	38.5		22.4		35.5		44.9		55.1		60.6		64.2		63.8		72.9		65.9		100.0	

TABLE NO. 32

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	4	7	24	27	53	51	51	50	56	51	27	34	15	8	5	3						
P. Public	50.0	38.9	33.8	41.6	54.1	55.1	48.5	55.0	62.7	75.0	46.4	65.3	53.6	50.0	83.4	75.0						
			2	4	11	16	26	26	32	42	38	41	26	24	20	17	6	4	6	0	5	2
G. Public			18.2	57.2	55.0	69.6	66.7	60.6	59.2	68.9	71.4	80.4	70.2	75.1	64.6	73.2	75.0	57.2	85.7	.0	83.1	100.0
	1	1	19	14	29	39	41	65	89	76	85	122	111	157	53	102	38	52	7	21	2	3
Catholic	25.0	25.0	45.4	39.8	47.8	49.4	48.4	63.7	66.8	71.7	57.8	73.2	79.9	81.6	70.0	81.6	88.5	80.1	77.8	87.6	100.0	100.0
Total for	5	8	45	45	93	104	118	141	177	169	150	197	152	189	78	124	44	56	13	21	7	5
all schools	41.7	36.4	36.5	41.4	52.1	54.1	51.4	59.8	55.2	71.7	58.5	72.9	74.8	79.2	68.6	80.6	86.2	77.8	81.3	84.0	100.0	100.0
Total for	13		90		197		259		346		347		341		202		100		34		12	
both sexes	38.2		38.9		53.0		55.7		62.3		65.9		77.1		75.3		81.0		83.0		100.0	

interpretations, including the three which were accepted as correct, were given for this picture. They are presented in Table No. 33 in the following order:

I. Gossip.

II. Eavesdropping.

III. Modesty or immodesty.

IV. Neglected or "snubbed."

V. Worrying others with the story of your troubles.

VII. An apparition appearing to two girls (guardian angel, their dead mother, or sister).

"Eavesdropping" and "gossip" predominate as interpretations of this picture. "Eavesdropping" is the more general interpretation up to the age of 16 after which "gossip" is more frequently mentioned. This may be indicative of a change in the individual's outlook on society. Placing himself in the position of the young girl behind the palms who is the central figure of the picture, he develops from the offender listening to a conversation not meant for him, to the offended overhearing a bit of gossip about him-

TABLE NO. 33

(Principle)	I		II		III		IV		V		VII		VIII	
Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G
Age	1	4	4	8	0	1	0	1	0	1	1	1	0	1
9	8.3	9.1	33.3	18.2	.0	4.6	.0	4.6	.0	4.6	8.3	4.6	.0	4.6
	13	15	29	32	1	1	8	10	0	1	6	2	0	1
10	10.5	13.8	23.5	29.4	0.8	0.9	64.8	9.2	.0	0.9	48.6	1.8	.0	0.9
	22	37	59	52	1	0	26	11	0	0	12	3	2	0
11	12.3	19.2	33.0	27.0	0.6	.0	14.6	5.7	.0	.0	6.7	1.6	1.1	.0
	29	56	75	74	31	0	0	21	0	2	14	7	5	2
12	12.6	23.9	32.7	31.5	13.5	.0	.0	8.9	.0	0.9	61.0	3.0	21.8	0.9
	73	69	96	86	2	1	11	19	0	0	10	6	5	1
13	22.8	29.2	30.0	36.5	6.2	0.4	34.3	8.1	.0	.0	31.2	2.5	15.6	0.4
	58	108	85	82	1	6	23	16	2	2	7	4	6	5
14	22.6	40.0	33.2	30.3	0.4	2.2	9.0	5.9	0.8	0.7	2.7	1.5	2.3	1.9
	67	81	81	99	4	2	11	13	0	1	5	1	6	3
15	33.0	33.9	39.8	41.5	19.7	0.8	54.1	54.5	.0	0.4	24.6	0.4	29.5	1.3
	28	75	44	40	2	2	8	9	0	1	6	2	2	3
16	24.6	48.8	38.7	26.0	1.8	1.3	7.0	5.9	.0	0.7	5.3	1.3	1.8	2.0
	27	44	15	17	0	4	2	0	0	0	0	0	2	2
17	52.9	61.2	29.4	23.6	.0	5.6	3.9	.0	.0	.0	.0	.0	3.9	2.8
	7	9	8	9	0	0	0	1	0	1	0	1	0	0
18	43.8	36.0	50.0	36.0	.0	.0	.0	4.0	.0	.0	.0	4.0	.0	.0
	6	2	1	1	0	0	0	0	0	0	0	0	0	0
Ad.	85.7	40.0	14.3	20.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

self. But whatever this change may mean subjectively in the development of the individual, it marks, objectively, the ability to distinguish and the tendency to interpret in terms of a greater wrong at a more mature age.

The value of the pictures lies in the fact that no interpretation of the situation presented is possible unless the child is familiar with it and understands something of its significance. An interpretation of a picture, therefore, shows beyond question of doubt that the child has some knowledge of the subject suggested, and that the principles which he reveals in his interpretation disclose the ideals by which he judges conduct.

CHAPTER VI

Results obtained by Direct Questioning and Special Tests

We will next consider in the order in which they were presented to the children, the groups of questions in Part II of our blank. The subject is asked in the first test whether or not he considers it a sin to do certain things. There is recorded in the Tables following the absolute numbers and the percentages of those answering in the affirmative.[1] The questions require the answer "Yes" or "No" to a specific act universally considered, that is, without regard for exceptions to the rule. The results recorded in all the Tables which follow give the percentage of children answering "Yes" to the question, regardless of whether or not it is the correct answer.

Is it a sin to stay away from church on Sunday?

Table No. 34 below indicates that the response of the majority of children whether from the public schools or the Catholic schools is an affirmative one. If we consider the lowest percentages between the ages of ten and sixteen inclusive, we find the following: S. Public—Age 14 B—56.3 percent;—P. Public—Age 15 B—66.7 percent;—G. Public—Age 11 G—60.9 percent;—Catholic—Age 12 G—96.8 percent.

The total for all schools shows the lowest average for the boys to be 89.0 percent, given at 14 years and for the girls 90.1 percent given at 13 years. The final average shows that the lowest score between 10 and 16 years is made at 12 years where the average is 90.2 percent.

It is to be noted that the percentage of affirmative answers is higher at every age for Catholic than for public school children and that whereas, at the higher ages notably from 13 on, the percentages decline for the public school subjects, they do not for the Catholic. This variation is to be expected because of differences in doctrinal teaching of Catholic and non-Catholic. The answer "Yes" is the correct one to this question for all ages.

[1] For explanation of form of Table see p. 22.

TABLE NO. 34

Is it a sin to stay away from church on Sunday?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public									0	0	3	3	10	3	10	6	9	10	5	9	3	3		1				
									.0	.0	100.0	100.0	90.9	60.0	90.9	66.7	56.3	90.9	83.3	81.8	100.0	100.0		50.0				
P. Public							1	0	10	13	21	19	26	24	26	23	15	11	6	2	3	2						
							100.0	.0	76.9	92.9	95.6	95.0	84.0	85.7	74.4	85.1	71.4	84.6	66.7	100.0	100.0	100.0						
G. Public									8	12	18	14	27	34	38	48	38	43	28	25	19	15	7	8	9	1	2	2
									100.0	100.0	90.0	60.9	75.1	77.2	82.5	84.0	79.0	86.0	73.6	80.8	67.8	83.4	63.6	100.0	81.8	33.3	33.3	66.7
Catholic							20	14	90	72	94	117	107	103	140	81	150	148	149	183	81	124	44	69	9	24	2	13
							100.0	100.0	98.1	100.0	97.8	100.0	98.4	96.8	99.4	98.8	99.0	99.2	100.0	100.0	100.0	99.2	100.0	98.7	100.0	92.4	100.0	100.0
C. I.	8	4	17	20	9	19	5	2	13	1																		
	100.0	100.0	94.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0																		
C. I. W.	3	6	5	13	6	6	3	3	6	6	2	1																
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0																
Total for all schools	11	10	22	33	15	25	29	19	127	104	138	154	170	164	214	158	212	212	188	219	106	140	51	78	18	25	4	15
	100.0	100.0	95.5	100.0	100.0	100.0	100.0	100.0	96.5	98.8	96.6	93.9	90.1	90.2	92.1	90.1	89.0	95.4	92.1	96.4	92.2	96.6	92.8	97.5	90.0	86.3	50.0	93.8
Total for both sexes	21		55		40		48		231		292		334		372		424		407		246		129		43		19	
	100.0		98.2		100.0		100.0		97.0		94.9		90.2		91.1		92.0		94.8		95.7		95.5		87.7		79.2	

Is it a sin to go to bed without saying your prayers? (Table No. 35).

This second question of religious duty shows that the vast majority of children do consider neglecting one's prayers a sin. At the age of 6 the belief in the obligation is practically unanimous and continues to be held by almost all children up to the age of 11. In the Catholic schools all averages up to the age of 15 are over 90 percent. After this age scepticism regarding the existence of this duty increases and is more apparent in the boys than in the girls. At 17, out of a total number of forty-four cases of Catholic boys but twenty-five or 56.8 percent consider this a sin, while at the same age 87.2 percent of the girls hold it a sin. In the final summation it will be noted that the maximum percentage of affirmative answers is given at 11 years and that with the exception of the 12 year-old average percentage which falls below the 13 year-old average, there is a gradual lowering of percentages until at adult age it reaches 70.9 percent.

These averages point to the fact that children of all denominations consider prayer an important duty. As to the morality of the problem of saying one's prayers, there is a religious obligation for man to ask God for the grace and help of which he stands in need. At least those who recognize the Christian concept of God will accept this principle. It would, therefore, be morally wrong to neglect prayer totally. There is, however, no clearly defined obligation to pray every morning or evening. Children at an early age should be taught to develop the habit of morning and evening prayer. A child who voluntarily neglects an act which tends to the development of this habit may perhaps be looked upon as guilty of a trivial offense against the law of man's duty of prayer. The point on which one should insist at an early age should be the duty of developing the habit, and not that occasional omissions are grievously wrong. In our paper we considered an answer "Yes" as correct inasmuch as it showed the existence of a moral consciousness that is fundamentally correct. Though Moral Theology may technically declare that a single omission of night prayers is not in itself sinful, neverthe-

TABLE NO. 35

Is it a sin to go to bed without saying your prayers?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
										2	3	3	10	3	10	7	14	11	6	11	3	3	0	2				
S. Public										100.0	100.0	100.0	90.9	60.0	90.9	77.8	87.5	100.0	100.0	100.0	100.0	100.0	.0	100.0				
							1	0	13	13	19	19	27	26	30	26	20	13	6	2	2	2						
P. Public							100.0	.0	100.0	92.9	86.5	95.0	87.2	92.8	85.8	96.3	95.2	100.0	66.7	100.0	66.7	100.0						
									7	12	20	23	30	41	40	55	40	47	30	29	26	15	8	7	8	2	2	3
G. Public									87.5	100.0	100.0	100.0	83.4	93.1	86.8	96.3	83.2	94.0	78.9	93.7	92.8	83.4	72.7	87.5	72.7	66.7	33.3	100.0
							18	14	89	69	94	118	101	96	136	76	142	146	123	158	63	100	25	61	6	21	1	11
Catholic							90.0	100.0	97.0	94.5	97.8	97.9	92.9	90.2	96.6	92.7	93.7	92.0	82.4	86.9	78.7	81.0	56.8	87.2	66.7	80.9	50.0	84.6
	8	4	18	19	9	19	5	2	13	1																		
C. I.	100.0	100.0	100.0	95.0	100.0	100.0	100.0	100.0	100.0	100.0																		
	3	6	5	13	6	6	3	3	6	6	2	1																
C. I. W.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0																
Total for	11	10	23	32	15	25	27	19	128	103	138	164	168	166	216	164	216	217	165	200	94	116	33	70	14	23	3	14
all schools	100.0	100.0	100.0	97.0	100.0	100.0	93.2	100.0	97.3	95.8	96.6	98.4	89.0	91.3	92.9	93.5	90.7	93.3	80.9	88.0	81.8	81.2	60.1	87.5	70.0	79.4	38.0	87.5
Total for	21		55		40		46		231		302		334		380		433		365		210		103		37		17	
both sexes	100.0		98.1		100.0		95.7		96.6		97.5		90.2		93.1		92.2		85.0		81.7		76.2		75.5		70.9	

less our data show that children who have no conscience on this point are abnormal in their moral development. The answer "Yes" is scored plus up through the 18 year-old group—the average adult may answer either "Yes" or "No."

Is it a sin not to say "grace" before meals? (Table No. 36.)

This third question also concerns religious duty, yet a duty of much less importance than either of the others considered. It is found that little children do not show much power of discrimination in regard to the duty mentioned, but that from 9 years where the percentage of affirmative answers drops below eighty for the first time, there is a regular decrease in the percentages until the 16 year-old level, when they fall below 50.0 percent, and remain below this limit through the adult age group. The normal child up to the age of 11, it may be said, will answer "Yes" to this question, but beyond that age the answer will be doubtful, depending presumably on the training received. The child who answers "No" before the age of 11 is more developed, for some reason, than the average child of his age.

Is it a sin to talk about someone you do not like? (Table No. 37.)

In this question the principle involved changes from one of religious duty to that of charity to our neighbor. The question was given in its present form rather than simply "to talk about someone" because it was felt that often the individual allows his performance of a moral duty to be influenced by his emotions. Thus, if one recognizes a duty of charity to those who are naturally repugnant to him, we may conclude he will recognize this duty generally.

The data given in Table No. 37 shows that all public school children whether they are from the city or from the suburban districts, have about the same sense of responsibility in regard to the character of their neighbor. Catholic school children show a slightly greater awareness of this obligation than do the public school children and in all cases girls seem to feel the responsibility more than boys do. A consideration of the final summation between the ages of 10 and 16, at each of which years we have

TABLE NO. 36

Is it a sin not to say "grace" before meals?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										2	2	3	8	2	7	5	14	11	6	5	2	3		0				
										100.0	66.7	100.0	88.9	40.0	63.6	55.6	87.5	100.0	100.0	45.5	66.7	100.0		.0				
P. Public							0		12	11	16	19	24	22	23	20	15	9	5	1	1	1						
							.0		92.3	78.5	72.8	95.0	77.5	78.5	65.8	74.0	71.4	69.2	55.6	50.0	33.3	50.0						
G. Public									8	10	15	18	20	34	34	39	28	42	26	20	17	15	5	4	6	1	2	2
									100.0	83.3	75.0	78.3	55.6	77.2	73.8	68.2	58.2	84.0	68.4	60.6	60.7	78.9	45.5	50.0	54.5	33.3	33.3	66.7
Catholic							11	14	67	57	68	88	69	63	97	47	102	94	90	105	35	54	16	31	3	6	1	4
							55.0	100.0	73.0	79.2	81.1	73.0	63.5	59.2	68.9	57.3	67.3	63.0	61.2	57.8	43.1	43.7	36.3	44.3	33.3	23.1	50.0	30.8
C. I.	8	4	18	17	8	17	4	2	13	1																		
	100.0	100.0	100.0	85.0	88.9	89.4	80.0	100.0	100.0	100.0																		
C. I. W.	3	6	4	13	4	5	3	3	3	6	2	1																
	100.0	100.0	80.0	100.0	66.7	83.3	100.0	100.0	50.0	100.0	100.0	100.0																
Total for	11	10	22	30	12	22	18	19	103	87	103	129	121	121	161	111	159	156	127	131	55	68	21	35	9	7	3	6
all schools	100.0	100.0	95.7	90.9	80.0	88.0	62.1	100.0	78.3	84.4	72.1	77.4	64.1	66.6	69.2	63.3	70.1	66.8	62.9	57.2	47.9	47.6	38.2	44.8	45.0	24.2	38.0	37.5
Total for	21		52		34		37		190		232		242		272		315		258		123		56		16		9	
both sexes	100.0		93.1		85.0		77.1		79.8		74.5		65.3		66.6		67.7		60.1		47.7		42.0		32.6		37.5	

results on more than two hundred subjects, shows that the largest percentage answer in the affirmative at 10 years after which there is a slight decrease for two years, then at 13 an increase which continues until 16 at which time there is another decrease. This second decrease continues through the 17, 18 and adult groups. This test seems to indicate that belief in the moral responsibility of the individual to respect the character of his neighbor is widespread but that there is a dulling of moral acumen on this point in the later years of adolescence and early adult life. However, the average subject up through the age of 18 answers "Yes" to this question.

Is it a sin to talk in school? (Table No. 38.)

This question is so simple and the answer so obviously "No" that it was thought to be almost worthless. The Table below which gives in absolute numbers and in percent, the number answering "Yes" to the question shows how widespread is the misconception of the obligation. Even at 16 the final summation shows 35.8 percent of the cases answering "Yes" to the question while at 6 years all cases considered hold it a sin. This is considered sinful by a higher percentage of the children in the Catholic schools than of those in the public schools; and in general, the girls are more inclined to think it so than the boys.

The questions, *Is it a sin to throw snowballs?* and *Is it a sin to throw snowballs when forbidden to do so?*, were given for the purpose of seeing at what age children differentiate between an act that is morally indifferent and the same act when it has become morally significant because it is prohibited by lawful authority. A comparison of the results shows that this power of differentiation is noticeable at 9 and is clearly defined by the age of 12. Both Tables below present the children answering "Yes" to these questions. The answer "No" is, of course, the only one credited for the first question; "Yes" is the correct answer to the second question. The results for these questions are tabulated in Tables No. 39 and 40, respectively.

TABLE NO. 37

Is it a sin to talk about someone you do not like?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
(School)									0	1	3	3	10	5	9	8	9	11	5	9	2	3		2				
S. Public									.0	50.0	100.0	100.0	90.9	100.0	81.8	88.9	56.3	100.0	83.3	81.8	75.0	100.0		100.0				
							0		13	13	14	13	23	26	23	23	18	13	7	2	3	2						
P. Public							.0		100.0	92.9	63.7	95.0	74.3	92.8	82.9	85.1	85.7	100.0	77.8	100.0	100.0	100.0						
									6	11	16	22	26	21	33	48	34	43	31	26	15	12	7	6	9	1	3	2
G. Public									75.0	91.6	80.0	95.7	74.4	47.7	67.3	84.0	70.7	87.7	81.5	78.8	53.6	89.0	63.6	75.0	81.8	33.3	50.0	66 7
							17	14	76	71	84	110	95	93	125	77	133	131	130	169	63	112	36	60	6	20	2	10
Catholic							85.0	100.0	83.6	98.7	87.4	91.3	87.4	87.4	88.8	93.9	87.8	87.8	88.4	93.0	77.5	90.7	85.7	85.8	66.7	77.0	100.0	76.9
	8	4	15	15	9	18	4	2	12	1																		
C. I.	100.0	100.0	83.4	80.0	100.0	94.7	80.0	100.0	92.3	100.0																		
	3	6	4	12	6	5	3	3	5	6	2	1																
C. I. W.	100.0	100.0	80.0	92.3	100.0	83.3	100.0	100.0	83.3	100.0	100.0	100.0																
Total for	11	10	19	27	15	23	24	19	112	103	119	155	154	144	190	156	194	198	173	206	83	129	43	66	15	21	5	12
all schools	100.0	100.0	82.7	81.8	100.0	90.0	82.8	100.0	85.1	95.7	83.3	93.0	83.2	79.2	81.7	88.9	81.9	89.1	85.6	90.2	72.2	90.3	81.3	84.5	75.0	75.0	62.5	75.0
Total for	21		46		38		43		215		274		298		346		392		379		212		109		36		17	
both sexes	100.0		82.3		95.0		89.4		90.3		88.5		80.8		84.8		85.5		88.3		82.5		82.8		75.0		70.9	

TABLE NO. 38

Is it a sin to talk in school?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
										2	1	3	4	2	4	4	4	7	5	5	2	2		1				
S. Public										100.0	33.3	100.0	36.4	40.0	36.4	44.4	25.0	63.6	83.3	45.4	66.7	66.7		50.0				
							1		9	9	14	17	17	20	24	19	5	7	3	1	1	0						
P. Public							100.0		69.2	64.3	63.7	85.0	54.9	71.4	68.6	70.3	23.8	53.8	33.3	50.0	33.3	.0						
									5	6	10	22	14	21	20	24	14	21	11	10	9	4	1	8	2	1	0	0
G. Public									62.5	50.0	50.0	95.7	38.9	47.7	43.4	42.0	29.1	42.8	28.9	30.3	32.1	22.2	8.3	100.0	18.2	33.3	.0	.0
							12	6	57	55	67	80	78	76	92	52	82	92	65	108	23	52	9	19	1	6	2	4
Catholic							60.0	42.8	62.7	76.5	71.8	66.4	71.8	71.4	65.3	63.4	54.1	61.6	44.2	59.4	28.3	42.1	20.4	27.2	11.1	23.1	100.0	30.8
	8	4	17	18	9	18	5	2	13	1																		
C. I.	100.0	100.0	94.5	90.0	100.0	94.7	100.0	100.0	100.0	100.0																		
	3	6	4	13	4	5	3	3	5	6	2	1																
C. I. W.	100.0	100.0	80.0	100.0	66.7	83.3	100.0	100.0	83.3	100.0	100.0	100.0																
Total for	11	10	21	31	13	23	21	11	89	79	82	123	113	119	140	99	105	127	84	124	35	58	10	27	3	7	2	4
all schools	100.0	100.0	91.4	93.9	86.7	95.9	72.5	57.9	67.6	74.7	64.4	73.8	59.9	65.5	60.2	56.4	45.7	55.6	41.9	51.8	30.5	40.0	17.9	19.7	15.0	25.9	25.0	25.0
Total for	21		52		36		32		168		205		232		239		232		208		93		37		10		6	
both sexes	100.0		93.1		92.2		66.6		70.6		69.3		62.6		58.6		50.8		46.2		35.8		27.9		21.3		25.0	

TABLE NO. 39

Is it a sin to throw snowballs? (Percent answering YES.)

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
										1	1	0	4	2	4	4	6	5	3	6	1	2		2				
S. Public										50.0	33.3	.0	36.4	40.0	40.0	44.4	37.5	45.4	50.0	54.5	33.3	66.7		100.0				
							1		7	5	12	15	13	11	10	10	3	0	1	1	1	0						
P. Public							100.0		53.8	35.7	54.6	75.0	42.0	39.3	27.8	37.0	14.3	.0	11.1	50.0	33.3	.0						
									5	3	5	8	3	12	10	23	11	16	9	12	4	1	0	7	2	1	0	0
G. Public									62.5	25.0	25.0	26.1	8.3	27.2	21.7	40.3	22.9	34.1	23.7	37.6	14.3	11.1	.0	87.5	18.2	33.3	.0	.0
							5	4	22	31	23	32	24	26	23	11	22	13	13	14	3	8	2	3	1	3	1	0
Catholic							25.0	28.6	24.2	43.1	23.9	26.6	22.1	24.4	16.3	13.4	14.5	8.8	8.8	7.7	3.7	6.5	4.5	4.3	11.1	11.6	50.0	.0
	7	3	16	17	8	18	4	2	11	1																		
C. I.	87.5	75.0	99.0	85.0	88.9	94.7	100.0	100.0	84.6	100.0																		
	3	6	3	12	2	4	3	2	3	3	1	1																
C. I. W.	100.0	100.0	60.0	92.3	33.3	66.7	100.0	66.7	50.0	50.0	50.0	100.0																
Total for	10	9	19	29	10	22	13	8	48	44	42	56	44	51	47	48	42	34	26	33	9	11	2	10	3	4	1	0
all schools	90.9	90.0	82.7	93.7	66.7	88.0	46.4	42.1	36.5	40.9	29.4	33.6	23.8	28.1	20.3	27.4	17.7	15.5	12.9	14.5	7.8	7.7	4.5	12.8	15.0	10.4	12.5	.0
Total for	19		48		32		21		92		98		95		95		76		59		20		12		7		1	
both sexes	90.4		88.8		80.0		44.7		38.6		32.1		25.7		23.4		16.7		13.7		7.7		9.7		14.6		4.8	

TABLE NO. 40

Is it a sin to throw snowballs when forbidden to do so?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
										2	2	0	11	4	9	7	15	10	5	10	1	2		2				
S. Public										100.0	66.7	.0	100.0	80.0	90.0	77.8	93.8	90.9	83.3	90.9	33.3	66.7		100.0				
							0		12	53	22	20	30	27	33	26	19	13	9	2	3	2						
P. Public							.0		92.3	77.9	100.0	100.0	96.9	96.4	94.4	97.2	90.4	100.0	100.0	100.0	100.0	100.0						
									7	11	20	22	35	44	43	54	44	43	34	32	26	12	10	8	10	2	5	3
G. Public									87.5	91.6	100.0	95.7	94.5	100.0	93.3	94.5	91.5	91.6	89.4	100.0	92.8	89.0	90.9	100.0	90.9	66.7	83.3	100.0
							19	14	83	69	94	117	101	102	135	79	150	147	144	183	72	119	42	67	9	26	2	13
Catholic							95.0	100.0	91.2	95.9	95.5	97.1	92.9	95.9	93.9	96.4	99.0	99.9	97.9	100.0	90.0	96.4	95.3	95.8	100.0	100.0	100.0	100.0
	8	4	17	18	9	19	5	2	12	1																		
C. I.	100.0	100.0	94.5	90.0	100.0	95.0	100.0	100.0	92.3	100.0																		
	3	6	5	13	6	5	3	3	6	5	1	1																
C. I. W.	100.0	100.0	100.0	100.0	100.0	83.3	100.0	100.0	100.0	83.3	50.0	100.0																
Total for	11	10	22	31	15	24	27	19	120	141	139	160	177	177	220	166	228	213	192	227	102	135	52	75	19	28	7	16
all schools	100.0	100.0	95.7	93.9	100.0	92.4	93.2	100.0	91.2	87.4	97.3	96.0	93.8	97.4	95.5	94.6	96.2	97.1	95.0	99.4	89.8	94.5	94.6	96.0	95.0	96.6	87.5	100.0
Total for	21		53		24		46		261		299		354		386		441		419		237		127		47		24	
both sexes	100.0		94.8		97.6		95.7		89.6		96.6		95.6		95.3		96.6		97.2		92.2		95.3		95.9		95.9	

Is it a sin to tell or listen to a bad joke or story?, and *Is it a sin to look at pictures that are not nice?,* were designed to bring out the attitude of the child on the obligation to keep one's mind pure. The increase of belief in the conviction that it is a sin shown by the children in the Catholic schools and the similar increase shown by the public school girls at the higher ages as compared with the decrease of belief shown by the public school boys, is worthy of note. Is it possible that this is an indication of the double standard of morality so prevalent in our society? The percentages of the children giving correct responses at 6 and 7 are lower comparatively than those at the higher ages. This can hardly be due to the fact that the younger children consider these things less wrong than older children but rather that they do not comprehend the problem given them. On the other hand the number of correct answers at these lower ages indicates that the wording of the question was faulty. The children knew, of course, that it was wrong to do anything that was not "nice" or that was "bad" and answered correctly although they had no specific insight into the problem presented (Tables No. 41 and 42).

A moral situation which the child is occasionally called upon to meet is suggested in the question *Is it a sin to keep the change if the clerk gives you too much?* The large majority answer in the affirmative which is the answer credited. However, the children from the semi-rural districts represented by G. Public and S. Public schools are slightly less positive than are the city children represented by P. Public and the Catholic schools. At practically all ages also the girls show a higher percentage than the boys. The difference in both cases, however, is so small as to be negligible (Table No. 43).

Is it a sin to fight? (Table No. 44.)

The 6-year-olds are thoroughly convinced that it is, but as we increase the age the conviction becomes less marked. However, even at the higher ages at least one-half the cases consider the act wrong. The attitude of the younger children on this question may be due to the fact that usually fighting involves an

TABLE NO. 41

Is it a sin to tell or listen to a bad joke or story?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										2 100.0	2 66.7	3 100.0	10 90.9	5 100.0	8 80.0	7 77.8	14 87.5	11 100.0	5 83.4	9 81.8	2 66.7	2 100.0		2 100.0				
P. Public							1 100.0		12 92.3	13 92.9	21 95.6	20 100.0	27 87.2	25 89.2	33 94.3	25 92.5	18 85.7	13 100.0	7 77.8	2 100.0	3 100.0	2 100.0						
G. Public									8 100.0	11 91.6	18 90.0	22 95.7	32 94.1	40 90.8	38 82.5	50 87.5	39 81.1	43 91.6	32 81.9	29 90.8	20 71.4	16 89.0	8 72.7	8 100.0	11 100.0	1 33.3	2 33.3	1 33.3
Catholic							20 100.0	12 92.3	85 93.5	72 100.0	94 97.8	119 98.8	102 93.8	101 94.9	136 96.6	78 95.2	151 99.7	148 100.0	143 97.2	182 99.9	80 98.4	122 98.8	44 100.0	69 98.7	9 100.0	24 92.4	2 100.0	12 92.3
C. I.	5 83.4			7 87.5	3 75	8 100.0	5 100.0	0 .0	13 100.0	1 100.0																		
C. I. W.					1 100.0	1 50.0	1 100.0	2 100.0	6 100.0	4 100.0	2 100.0	1 100.0																
Total for all schools	5 83.4			7 87.5	4 80.0	9 90.0	27 96.4	14 94.2	124 84.2	103 98.0	137 95.9	165 69.0	171 90.6	171 94.1	215 92.7	160 91.2	222 93.5	215 98.5	187 92.6	212 97.5	105 91.4	138 97.1	52 94.6	77 98.6	20 100.0	25 86.3	4 50.0	13 81.3
Total for both sexes	5 83.4		7 87.5		13 86.7		41 95.5		227 95.8		252 81.1		342 92.3		375 92.3		437 95.7		409 95.7		243 94.4		129 96.8		45 91.8		17 70.9	

TABLE NO. 42

Is it a sin to look at pictures that are not nice?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										1 50.0	2 66.7	3 100.0	11 100.0	4 80.0	8 80.0	8 88.9	12 75.0	11 100.0	4 66.7	10 90.9	2 66.7	2 100.0		2 100.0				
P. Public							1 100.0		11 84.6	13 92.9	18 81.9	20 100.0	26 84.0	25 89.3	32 91.5	25 92.5	17 80.9	13 100.0	7 77.8	2 100.0	3 100.0	2 100.0						
G. Public									7 87.5	11 91.6	18 90.0	21 91.4	31 83.7	41 93.1	38 82.5	50 84.5	39 81.1	43 91.6	34 87.0	29 90.8	19 67.8	17 94.5	8 72.7	8 100.0	11 100.0	1 33.3	2 33.3	2 66.7
Catholic							18 90.0	13 100.0	85 93.5	72 100.0	91 96.5	116 97.4	103 94.8	102 95.9	137 97.3	81 98.8	149 98.3	146 99.3	144 97.9	179 98.5	74 94.7	122 98.8	44 100.0	67 95.8	8 88.9	26 100.0	2 100.0	12 92.3
C. I.	4 66.7			6 75.0	1 100.0	8 100.0	5 100.0		13 100.0	1 100.0																		
C. I. W.					1 100.0	1 50.0	1 100.0	2 100.0	6 100.0	4 100.0	2 100.0	1 100.0																
Total for all schools	4 66.7			6 75.0	2 100.0	9 90.0	25 92.5	15 100.0	122 92.7	101 97.0	131 91.7	161 96.6	171 90.6	172 94.6	215 92.7	164 92.6	217 91.4	213 97.6	189 93.6	220 96.6	98 87.2	139 97.3	52 94.6	75 96.0	19 95.0	27 93.2	4 50.0	14 87.5
Total for both sexes	4 66.7		6 75.0		11 91.6		40 95.2		223 95.0		292 94.9		343 92.3		379 92.9		430 94.2		409 95.7		237 93.1		127 95.3		46 93.8		18 75.1	

TABLE NO. 43

Is it a sin to keep the change if the clerk gives you too much?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
(School)										1	2	3	10	5	9	9	14	10	5	10	2	2		2				
S. Public										50.0	66.7	100.0	90.9	100.0	90.0	100.0	87.5	90.9	83.4	90.9	66.7	100.0		100.0				
							1		13	13	21	18	30	27	34	27	20	13	8	2	3	2						
P. Public							100.0		100.0	92.9	95.6	90.0	96.9	96.4	97.2	100.0	95.2	100.0	88.9	100.0	100.0	100.0						
									7	12	20	21	33	43	39	52	41	43	38	30	25	17	10	8	11	2	3	3
G. Public									87.5	100.0	100.0	91.4	91.7	97.6	84.6	93.1	85.3	91.6	97.3	93.9	89.3	94.5	90.9	100.0	100.0	66.7	50.0	100.0
							18	13	86	71	92	115	102	100	134	81	148	146	136	181	76	123	40	69	8	25	2	13
Catholic							90.0	100.0	94.6	98.7	97.5	96.6	93.8	94.0	95.1	98.8	97.7	99.3	92.5	99.6	93.5	99.6	90.8	98.7	88.9	96.3	100.0	100.0
	8	3	17	18	8	18	5	2	13	1																		
C. I.	100.0	75.0	94.5	94.7	88.9	100.0	100.0	100.0	100.0	100.0																		
	2	5	4	13	5	4	3	3	6	6	2	1																
C. I. W.	66.7	83.4	80.0	100.0	83.4	66.7	100.0	100.0	100.0	100.0	100.0	100.0																
Total for	10	8	21	31	13	22	27	18	125	104	137	158	175	175	216	169	223	212	187	223	106	140	50	79	21	27	5	16
all schools	90.9	80.0	91.4	97.0	86.7	91.7	93.2	100.0	95.0	86.3	95.9	94.8	92.8	96.3	93.1	96.3	93.9	97.3	92.6	97.9	92.2	98.0	90.9	98.8	95.5	93.1	62.5	100.0
Total for	18		52		35		45		229		295		350		385		435		410		246		129		48		21	
both sexes	85.7		94.6		89.6		95.9		96.2		95.9		94.5		94.7		96.1		95.9		95.7		97.0		48		87.5	

TABLE NO. 44

Is it a sin to fight?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										2	2	3	10	4	5	9	9	8	3	6	2	2		1				
										100.0	66.7	100.0	90.9	80.0	50.0	100.0	56.3	72.7	60.0	66.7	66.7	100.0		50.0				
P. Public							1		12	11	16	20	23	24	25	22	13	12	7	1	2	2						
							100.0		92.3	78.5	72.8	100.0	74.3	85.7	71.5	81.4	61.9	92.3	77.8	50.0	66.7	100.0						
G. Public									8	12	20	19	21	40	32	44	30	41	16	23	15	12	6	5	2	2	2	1
									100.0	100.0	100.0	82.7	60.1	90.8	69.4	77.0	62.4	87.3	41.0	75.9	53.6	66.7	54.5	62.5	18.2	66.7	33.3	33.3
Catholic							14	13	81	70	78	113	97	94	117	77	125	125	102	146	48	91	27	40	4	17	1	9
							70.0	100.0	89.1	97.3	82.7	94.9	89.2	88.4	63.1	93.9	82.5	85.0	69.4	80.3	59.0	73.7	61.3	57.2	44.4	65.5	50.0	69.2
C. I.	8	4	16	19	9	18	5	2	13	1																		
	100.0	100.0	88.8	95.0	100.0	100.0	100.0	100.0	100.0	100.0																		
C. I. W.	3	6	5	13	6	4	3	3	6	6	2	1																
	100.0	100.0	100.0	100.0	100.0	66.7	100.0	100.0	100.0	100.0	100.0	100.0																
Total for all schools	11	10	21	32	15	22	23	18	120	102	118	156	151	162	179	152	177	186	128	176	67	103	33	46	6	19	3	10
	100.0	100.0	91.4	97.0	100.0	91.7	79.4	100.0	91.2	94.9	82.6	93.6	81.5	89.1	77.1	86.6	74.5	85.4	63.9	77.8	58.3	72.1	60.1	57.5	30.0	65.6	42.9	62.5
Total for both sexes	21		53		37		41		222		274		313		331		363		304		170		79		25		13	
	100.0		94.9		94.7		87.3		93.2		89.1		84.8		81.4		80.0		71.4		66.1		58.5		51.0		76.4	

act of disobedience and as is shown elsewhere, to obey is the first moral law which the child knows. The answer "Yes" is counted correct through the age of 14 after which age, the response cannot be scored as either correct or incorrect.

Is it a sin to cheat? (Table No. 45.)

"To cheat" is universally considered a wrong thing to do, if we may judge from the large percentages answering this question in the affirmative. "Yes" is, therefore, the correct answer to this question at all ages.

Is it a sin to flirt? (Table No. 46.)

The answer of a large group of adults on this question would be enlightening considering the prevalency of the habit. While we may say definitely that it is not a sin in the sense in which the word "flirting" is usually understood, that is, as the attempt to merely attract the attention of a person of the opposite sex, nevertheless it is admittedly vulgar. The results at 6 and 7 in our Table may be thrown out because the child when asked to explain his answer either could not do so or had a false concept of what "to flirt" meant. A false moral concept of this action is certainly prevalent among children—more so among girls at all ages than among boys—but it tends to correct itself as the child grows older. However, the number persisting in this concept even at adult age is surprising. In scoring the answers to this question "Yes" is counted the correct answer for the average child through the age of 11, after which age the answer cannot be scored as either right or wrong.

Group II presents a series of simple situations which the child is asked to solve. Each of these situations involves some moral concept.

The first problem, *What should you do if you saw a lady in front of you drop a five dollar bill?*, proves by the almost unanimous reply "Pick it up and give it to her," that honesty as a fundamental principle, is grasped by the child at a very early age. Only an answer which brings out this principle of honesty is credited (Table No. 47).

TABLE NO. 45

Is it a sin to cheat?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public							1 100.0		12 92.3	13 92.9	22 100.0	20 100.0	28 90.4	27 96.4	30 88.2	23 100.0	19 90.4	13 100.0	8 88.9	2 100.0	3 100.0	2 100.0						
G. Public									7 87.5	12 100.0	20 100.0	23 100.0	29 93.7	43 97.6	41 93.1	52 94.6	45 93.6	45 97.7	35 100.0	31 93.9	27 96.4	17 94.5	11 100.0	8 100.0	11 100.0	1 100.0	6 100.0	3 100.0
Catholic							19 95.0	12 92.3	83 92.1	68 100.0	91 96.5	119 100.0	98 90.2	94 95.9	135 95.9	81 98.8	147 97.0	142 97.9	123 98.4	180 99.0	71 95.9	122 98.8	42 97.8	66 95.7	8 88.9	26 100.0	1 50.0	13 100.0
C. I.	8 100.0	4 100.0	15 93.8	17 89.4	9 100.0	13 100.0	5 100.0	2 100.0	13 100.0	1 100.0																		
C. I. W.	3 100.0	5 83.4	5 100.0	13 100.0	5 83.4	4 66.7	3 100.0	3 100.0	6 100.0	6 100.0	2 100.0	1 100.0																
Total for all schools	11 100.0	9 90.0	20 95.2	30 93.9	14 100.0	17 100.0	28 96.6	17 94.5	121 93.2	100 100.0	140 98.0	163 100.0	155 89.9	164 91.8	206 93.9	156 98.3	211 96.0	200 98.6	166 97.9	213 98.0	101 96.1	137 97.1	53 98.1	74 96.2	20 95.2	27 100.0	7 87.5	16 100.0
Total for both sexes	20 95.2		50 94.5		31 91.1		45 95.9		221 96.1		303 99.1		319 90.9		362 95.6		411 97.0		379 98.0		238 96.7		127 96.5		47 97.9		23 95.8	

TABLE NO. 46

Is it a sin to flirt?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public							0		9	11	19	19	24	21	23	19	8	12	6	1	2	1						
							.0		69.2	78.5	86.5	95.0	77.5	75.0	76.6	82.7	40.0	92.3	66.7	50.0	66.7	50.0						
G. Public									8	12	15	23	19	36	31	37	29	30	20	23	10	8	6	5	2	1	1	1
									100.0	100.0	75.0	100.0	57.6	81.7	70.4	67.3	60.3	65.1	57.2	72.0	35.7	66.7	54.5	62.5	18.2	50.0	16.7	33.3
Catholic							16	11	61	63	65	103	69	77	84	66	89	105	48	120	23	65	13	24	3	9	1	7
							80.0	84.6	69.5	93.9	68.9	86.5	64.2	78.5	59.6	80.5	58.7	73.5	39.4	66.0	31.5	52.7	30.3	34.8	33.3	34.7	50.0	53.8
C. I.	1	0	0	3	0	4	3	0	1	0																		
	100.0	.0	.0	75.0	.0	100.0	100.0	.0	7.7	.0																		
C. I. W.	0	1	0	0	0	1	0	1	4	2	1	0																
	.0	6.3	.0	.0	.0	100.0	.0	100.0	100.0	100.0	100.0	.0																
Total for all schools	1	1	0	3	0	5	19	12	83	88	100	145	112	134	138	122	126	147	74	144	35	74	19	29	5	10	2	8
	100.0	16.7	.0	75.0	.0	100.0	76.0	85.7	65.6	91.5	73.0	89.9	65.0	79.1	64.2	76.9	57.5	72.8	44.4	66.5	33.6	52.5	35.2	37.7	25.0	35.7	25.0	50.0
Total for both sexes	2		3		5		31		171		245		246		260		273		218		1 09		48		15		10	
	28.6		50.0		100.0		79.4		77.0		82.0		71.9		68.9		64.7		56.9		44.7		36.5		31.2		41.7	

TABLE NO. 47

What should you do if you saw a lady in front of you drop a five-dollar bill?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public													9	6	8	9	14	11	4	6	2	2		0				
													100.0	100.0	88.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0		.0				
P. Public							1	0	13	14	22	20	31	28	35	27	21	13	9	2	3	2						
							100.0	.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
G. Public									8	12	19	23	36	45	46	54	49	49	36	33	25	14	10	8	11	3	6	3
									100.0	100.0	95.0	100.0	97.3	97.7	100.0	100.0	100.0	100.0	94.7	100.0	96.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Catholic							20	12	84	68	93	118	104	104	136	81	151	147	149	183	81	124	44	70	9	25	1	13
							100.0	100.0	98.3	98.6	97.7	99.1	95.7	97.8	96.6	99.6	99.7	99.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	96.2	50.0	100.0
C. I.	7	4	18	20	9	19	5	2	13	1																		
	87.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0																		
C. I. W.	2	6	5	13	6	6	2	3	6	3	2	1																
	66.7	100.0	100.0	100.0	100.0	100.0	66.7	100.0	100.0	50.0	100.0	100.0																
Total for all schools	9	10	23	33	15	25	28	17	124	98	136	162	180	183	225	171	235	220	198	224	111	142	54	78	20	28	7	16
	81.8	100.0	100.0	100.0	100.0	100.0	96.6	100.0	98.4	99.0	97.8	99.4	96.8	98.4	97.9	100.0	99.6	99.5	99.0	100.0	99.1	100.0	100.0	98.7	100.0	96.6	87.5	100.0
Total for both sexes	19		56		40		45		222		298		363		396		455		422		253		132		48		23	
	90.5		100.0		100.0		97.8		97.4		98.9		97.6		99.0		99.6		99.5		99.6		99.3		98.0		95.8	

A more personal question is asked when the subject is requested to tell what he should do if his *playmate broke his checker-board.* Contrary to expectation a feeling of resentment or of anger does not overcome the principle of charity involved. One of the most uncharitable answers met was "If he did it on purpose, make him pay for it—if not, forgive him." The practical child occasionally revealed himself in the answer, "Fix it"—but in general the response was "Keep quiet" or "Forgive him." These answers all of which show that the child possesses some concept of his duty to be kind to his playmate, were credited as correct. Answers which showed no such appreciation were counted as wrong (Table No. 48).

A problem of politeness in a rather embarrassing situation is suggested in the question, *How should you act if your teacher scolded you for not having your lessons?* To have his answer considered correct the child must feel it his obligation to do more than "Keep quiet." The "Have them next time" answer showed the general seriousness with which a reprimand from the teacher is taken by the majority of children. Small children, however, consider their feelings very often and answer "Cry." Percentages here would seem to show that the authority of the teacher is not often called into question, especially after the age of 14 (Table No. 49).

A little information on the subject of authority in the home may be gleaned from the question, *How should you act if your mother told you to come home to go to the store and the boys wanted you to play ball?* Obedience is universal or practically so with children. All the children at 6 to whom the test was given would "Go home." There are a few indocile individuals between 8 and 13, but the number is very small. At 13 there is a re-awakening of the duty of fulfilling this obligation which persists into the adult age. Children universally recognize the necessity of complying with an express command from their parents. Knowing the right thing to do does not necessarily mean doing the right thing; and yet the child reasons according to experience, not according to abstract principles of right or wrong. Therefore,

TABLE NO. 48

What should you do if your playmate broke your checker-board?

Age	6		7		8		9		10		11	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G
S. Public												2
												100.0
P. Public							1		11	8	14	15
							100.0		84.6	57.1	63.7	75.6
G. Public									8	9	16	22
									100.0	75.0	80.0	94.7
Catholic							17	9	62	57	76	108
							85.0	81.8	73.2	82.7	79.8	91.8
C. I.	4	1	10	10	6	13	5	1	9	1		
	50.0	25.0	55.6	50.0	66.7	68.4	100.0	50.0	69.2	100.0		
C. I. W.	3	1	3	5	6	5	2	1	6	5	2	1
	100.0	16.7	60.0	38.5	100.0	83.3	66.7	33.3	100.0	83.3	100.0	100.0
Total for all schools	7	2	13	15	12	18	25	11	96	80	108	152
	63.6	20.0	56.6	45.5	80.0	72.0	86.3	68.8	76.8	78.4	73.4	82.1
Total for both sexes	9		28		30		36		176		260	
	42.8		50.1		75.0		79.9		77.4		77.5	

Age	12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public	8	6	6	7	12	11	3	5	2	2						
	88.9	100.0	60.0	77.8	85.7	100.0	75.0	83.3	100.0	100.0						
P. Public	28	15	27	26	20	13	9	2	3	2						
	90.4	53.6	77.2	96.3	95.2	100.0	100.0	100.0	100.0	100.0						
G. Public	19	37	28	42	41	40	30	28	23	12	10	7	8	3	5	3
	61.4	80.3	60.8	77.7	83.6	81.6	78.9	87.6	88.6	83.4	83.3	87.5	88.9	100.0	83.3	100.0
Catholic	86	94	112	67	133	136	136	172	72	113	41	64	9	23	2	11
	79.1	99.3	79.5	83.8	87.8	92.5	91.1	94.6	90.0	91.5	93.1	91.5	100.0	88.6	100.0	84.6
C. I.																
C. I. W.																
Total for all schools	141	152	173	142	206	200	178	207	100	129	51	71	17	26	7	14
	77.6	82.1	75.1	83.8	86.7	90.4	89.0	92.3	90.0	90.3	91.3	90.9	94.5	89.7	87.5	87.5
Total for both sexes	293		315		406		385		229		122		43		21	
	79.7		78.8		88.5		90.5		90.5		91.5		89.4		87.6	

TABLE NO. 49

How should you act if your teacher scolded you for not having your lessons?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public												2	7	4	6	6	7	11	3	5	2	2						
												100.0	77.8	66.7	60.0	66.7	77.8	100.0	75.0	83.3	100.0	100.0						
P. Public							1		11	12	19	17	26	27	31	23	17	13	9	2	2	2						
							100.0		76.9	85.7	86.5	85.0	84.0	96.4	88.7	85.1	80.9	100.0	100.0	100.0	66.7	100.0						
G. Public									5	6	17	23	20	36	26	32	35	29	15	24	21	13	9	4	3	1	3	2
									62.5	50.0	85.0	100.0	55.6	83.4	56.4	59.2	71.4	59.2	39.5	72.7	80.9	94.5	75.0	50.0	33.3	33.3	50.0	66.7
Catholic							16	8	68	59	78	88	86	92	118	75	136	137	136	177	74	118	40	68	8	26	2	11
							80.0	72.7	80.9	87.9	81.9	88.4	79.1	88.3	83.8	93.8	89.8	93.2	69.1	97.4	91.0	95.6	90.8	97.2	88.9	100.0	100.0	84.6
C. I.	6	4	13	12	6	14	5	0	8	1																		
	75.0	100.0	72.3	60.0	66.7	73.6	100.0	.0	61.5	100.0																		
C. I. W.	0	4	4	9	5	4	3	3	6	5	2	1																
	.0	66.7	80.0	69.2	83.3	66.7	100.0	100.0	100.0	83.3	100.0	100.0																
Total for all schools	6	8	17	21	11	18	25	11	98	83	116	131	139	159	181	136	189	196	163	208	99	135	49	72	11	27	5	13
	54.5	80.0	74.0	63.6	73.4	72.0	86.3	68.8	78.4	82.2	83.5	78.6	75.1	87.5	78.2	80.2	82.0	88.6	81.5	74.9	87.1	94.5	87.7	92.2	61.2	93.2	62.5	81.3
Total for both sexes	14		38		29		36		181		247		298		317		385		371		234		121		38		18	
	66.7		68.0		72.5		79.9		80.4		81.3		81.1		78.9		85.5		77.5		91.7		96.1		80.9		75.0	

TABLE NO. 50

How should you act if your mother told you to come home to go to the store and the boys wanted you to play ball?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
(School)												1	9	6	9	9	13	11	4	5	2	2						
S. Public												100.0	100.0	100.0	90.0	100.0	92.9	100.0	100.0	100.0	100.0	100.0						
							1		12	14	20	6	27	28	35	27	20	13	8	2	3	2						
P. Public							100.0		92.3	100.0	91.0	70.0	87.2	100.0	100.0	100.0	95.2	100.0	88.9	100.0	100.0	100.0						
									7	11	18	22	31	41	42	52	48	48	36	32	22	16	11	7	9	3	6	3
G. Public									87.5	91.6	90.0	95.7	88.7	91.0	95.3	96.2	97.9	97.9	90.0	100.0	84.7	89.0	91.6	87.5	100.0	100.0	100.0	100.0
							18	10	79	63	90	115	103	100	135	78	148	143	145	182	79	123	41	70	9	25	2	13
Catholic							90.0	90.9	94.1	92.6	94.5	97.8	94.8	96.0	95.1	97.5	97.7	97.2	97.2	99.4	97.2	99.6	93.1	100.0	100.0	96.2	100.0	100.0
	8	4	18	19	9	18	5	2	13	1																		
C. I.	100.0	100.0	100.0	95.0	100.0	94.7	100.0	100.0	100.0	100.0																		
	3	6	5	13	6	6	3	3	6	6	2	1																
C. I. W.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0																
Total for	11	10	23	32	17	24	27	15	117	95	110	145	170	175	301	166	229	215	193	221	108	139	52	77	18	28	8	16
all schools	100.0	100.0	100.0	97.0	100.0	96.0	93.2	93.8	94.8	94.1	92.4	90.0	91.8	96.3	97.2	97.9	97.1	97.2	95.5	99.0	96.1	97.3	93.1	98.6	100.0	96.6	100.0	100.0
Total for	21		55		41		42		212		255		345		467		444		414		247		129		46		24	
both sexes	100.0		98.2		97.6		93.2		94.6		90.8		93.8		97.6		97.2		97.2		97.3		96.8		98.0		100.0	

when children unanimously agree here that they should go home that is probably the thing experience has taught them it is right and good to do. Credit is given to the answer only when it shows the child's realization that he must obey (Table No. 50).

What should you do if you had a bag of pop-corn and were eating it when a little child looked up at you hungrily?

The good-fellowship and generosity of children at all ages is true in theory, at least, if we may judge from the answers to this question. The girls seem to be more generous than the boys in practically all cases. In general the results from all the schools tested show no differences which we might attribute to environment or training. The "big-sister" or "big-brother" instinct is probably a fundamental one. Unless the child is generous and will "Give him some" he receives no credit for his answer (Table No. 51).

Group III. This group is of particular interest as one which makes the child think and express his opinion on problems of a serious nature. Yet they are not problems outside the youngest child's range of information. He must reach some conclusion on each of them at a very early age, but naturally this conclusion is modified or completely changed as he grows older.

Thus, in the first question such a response as "I would not believe him" was considered a correct answer to, *What would you think if you heard a boy say "There is no God"?* In fact, any answer which would disprove the suggestion and show that the child believed that there is a God was considered as valid. The percentage of negative answers, small as it is, it may be pointed out, is not due in more than one or two cases to agreement with the statement. They are due to the fact that the child either did not understand the question or that for some reason known only to himself he ignored it. These percentages are most interesting and quite significant in showing that children universally believe in the existence of God in spite of the widely heralded atheism and apparent neglect of religious training (Table No. 52).

The second question follows up the idea of a Supreme Being

TABLE NO. 51

How should you act if you had a bag of pop-corn and were eating it when a little child looked up at you hungrily?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
												1	9	5	9	9	13	11	4	6	2	2						
S. Public												100.0	100.0	83.7	90.0	100.0	92.9	100.0	100.0	100.0	100.0	100.0						
							1		12	14	22	20	31	28	35	27	21	13	9	2	3	2						
P. Public							100.0		92.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0						
									8	12	19	22	34	43	43	54	47	48	36	32	24	16	10	6	9	3	6	3
G. Public									100.0	100.0	95.0	95.7	97.2	95.5	93.3	95.9	95.9	97.9	90.0	100.0	92.4	94.1	83.3	75.0	100.0	100.0	100.0	100.0
							19	10	82	66	90	115	103	101	140	78	150	146	146	182	80	123	43	69	9	26	2	13
Catholic							95.0	90.9	97.6	97.0	94.5	97.8	94.8	97.0	99.4	97.5	99.0	99.3	97.8	99.4	98.4	99.6	97.6	98.7	100.0	100.0	100.0	100.0
	8	4	18	19	9	19	5	2	13	1																		
C. I.	100.0	100.0	100.0	95.0	100.0	100.0	100.0	100.0	100.0	100.0																		
	3	6	5	13	6	6	3	3	6	6	2	1																
C. I. W.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0																
Total for	11	10	23	32	15	25	28	15	121	99	133	159	177	177	227	168	231	218	195	222	109	139	53	75	18	29	8	16
all schools	100.0	100.0	100.0	97.0	100.0	100.0	95.6	93.8	97.6	98.0	95.7	97.6	95.6	93.8	98.1	99.1	97.9	98.7	96.5	99.5	97.0	98.7	94.9	96.0	100.0	100.0	100.0	100.0
Total for	21		55		40		43		220		292		354		395		449		417		248		128		47		24	
both sexes	100.0		98.2		100.0		95.5		97.8		96.9		97.0		98.4		97.8		98.0		98.0		95.4		100.0		100.0	

TABLE NO. 52

What would you think if you heard a boy say "There is no God?"

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public												1	9	6	8	7	14	10	4	6	2	2						
												100.0	100.0	100.0	88.9	77.8	100.0	90.9	100.0	100.0	100.0	100.0						
P. Public							1		13	12	22	19	29	28	34	26	19	13	9	2	3	2						
							100.0		100.0	85.7	100.0	95.0	93.7	100.0	97.2	96.3	90.4	100.0	100.0	100.0	100.0	100.0						
G. Public									7	10	16	23	37	42	46	57	52	49	40	35	23	14	8	5	10	3	6	3
									87.5	83.3	84.2	100.0	97.3	95.3	90.2	95.2	94.6	85.8	95.2	94.5	92.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Catholic							17	9	78	63	88	114	99	99	129	76	143	142	141	178	76	119	43	68	9	26	2	13
							89.4	100.0	92.0	93.8	91.5	96.9	92.1	95.0	92.8	95.0	94.4	96.6	95.9	97.9	93.5	95.2	95.5	97.2	100.0	100.0	100.0	100.0
C. I.	8	4	17	17	9	19	5	2	13	1																		
	100.0	100.0	94.5	85.0	100.0	100.0	100.0	100.0	100.0	100.0																		
C. I. W.	3	6	5	9	6	4	3	3	6	6	2	1																
	100.0	100.0	100.0	69.2	100.0	66.7	100.0	100.0	100.0	100.0	100.0	100.0																
Total for all schools	11	10	22	26	15	23	26	14	117	92	128	158	174	175	217	166	228	214	194	221	104	137	41	73	19	26	8	16
	100.0	100.0	95.7	78.8	100.0	92.0	95.2	100.0	93.6	92.9	99.8	96.4	94.0	96.3	92.9	94.6	94.6	93.8	95.6	97.0	90.4	95.9	95.5	91.3	100.0	100.0	100.0	100.0
Total for both sexes	21		48		38		40		209		286		349		383		442		415		241		114		45		24	
	100.0		85.9		95.0		95.2		93.3		95.8		95.3		93.5		94.1		96.7		95.0		92.3		100.0		100.0	

by giving the child an opportunity to express his opinion concerning rewards and punishments in the next life. *What happens to a good little boy when he dies?* That he goes to "heaven" or perhaps to "purgatory" is never doubted; only these two of the answers are given credit. There is an occasional "I do not know," or "I do not understand," and with some of the smaller children an answer such as "He is buried" which shows a misconception of the question (Table No. 53).

Whom do you love best in all the world? and *Why?* were meant originally to bring out the place the Creator holds in the mind of the child as compared to the place assigned to creatures. "In all the world" led to the concept by many that the question asked was what person he loved best on earth. This necessitated counting two answers correct,—"God" and "parents" (guardians)—provided that the "why" revealed an appreciation of an obligation, *e.g.*, of gratitude. Children had no difficulty selecting the person who had the best right to their love but in a few cases the "why" was not answered. In two or three cases above 16 years the boys claimed to love "their girl" because she was the person they had decided to marry (Table No. 54).

In the next question, *Why were you made?*, the effect of training in the Catholic schools is very apparent. The question was put in this form rather than in the catechism form, "Why did God make you?" to prevent children from answering according to a memorized formula. That this end was attained in most cases, is apparent in that the answers do not take the form of the catechism but express in the child's own words his altruistic purpose in life. The question was misunderstood by a large number of public school children and was answered in view of the purpose of their pro-creation, *e.g.*, "Because my mother wanted me," or "Because my mother loves children." These answers were given no credit. The answers in all the school systems show an increased tendency toward altruism as the children grow older. Credit was given only where the individual expressed some motive of an altruistic nature or better, as the end for which he lives (Table No. 55).

TABLE NO. 53

What happens to a good little boy when he dies?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public												1	8	6	8	9	13	10	4	6	2	2						
												100.0	88.9	100.0	88.9	100.0	92.9	90.9	100.0	100.0	100.0	100.0						
P. Public							1	0	13	14	22	20	30	28	35	27	20	13	8	2	3	2						
							100.0	.0	100.0	100.0	100.0	100.0	96.9	100.0	100.0	100.0	95.2	100.0	88.9	100.0	100.0	100.0						
G. Public									7	12	18	22	36	42	50	59	54	56	40	36	22	17	8	5	10	3	6	3
									87.5	100.0	94.5	95.7	94.7	93.2	100.0	98.2	94.5	98.0	95.2	97.2	95.7	94.5	100.0	100.0	100.0	100.0	100.0	100.0
Catholic							19	9	84	66	91	113	102	102	136	80	149	147	146	181	99	123	44	69	9	26	2	13
							100.0	100.0	99.1	100.0	94.6	96.1	94.9	98.9	97.9	100.0	99.8	99.9	99.3	99.6	97.2	99.6	100.0	98.7	100.0	100.0	100.0	100.0
C. I.	8	4	17	19	9	17	2	5	13	1																		
	100.0	100.0	94.5	95.0	100.0	89.4	100.0	100.0	100.0	100.0																		
C. I. W.	2	6	5	11	6	5	3	3	6	6	2	1																
	66.7	100.0	100.0	84.6	100.0	83.3	100.0	100.0	100.0	100.0	100.0	100.0																
Total for all schools	10	10	22	30	15	22	25	17	123	99	133	157	176	178	229	175	236	226	198	225	126	140	52	74	19	29	8	16
	90.9	100.0	95.7	90.9	100.0	88.0	100.0	100.0	98.4	100.0	97.1	97.3	95.0	97.9	98.5	99.8	97.5	98.7	98.0	98.6	98.3	98.0	100.0	98.8	100.0	100.0	100.0	100.0
Total for both sexes	20		52		37		42		222		290		354		404		462		423		266		126		48		24	
	95.2		93.1		92.5		100.0		99.0		97.2		96.6		98.9		98.4		98.5		98.2		99.2		100.0		100.0	

TABLE NO. 54

Whom do you love best in all the world? Why?

Age Sex (School)	6 B	 G	7 B	 G	8 B	 G	9 B	 G	10 B	 G	11 B	 G	12 B	 G	13 B	 G	14 B	 G	15 B	 G	16 B	 G	17 B	 G	18 B	 G	Ad. B	 G
S. Public													6 66.7	1 16.7	7 77.8	9 100.0	6 46.1	9 81.8	2 50.0	4 66.7	3 100.0	3 100.0						
P. Public							1 100.0		12 92.3	13 92.9	21 95.6	19 95.0	30 96.9	26 92.9	30 88.2	24 88.8	19 90.4	11 84.6	8 88.9	2 100.0	2 66.7	2 100.0						
G. Public									7 88.9	10 83.3	18 94.7	22 95.7	30 78.9	38 84.4	47 94.0	56 93.5	47 85.5	50 87.5	39 92.8	31 83.7	20 87.0	15 83.4	7 87.5	5 100.0	9 90.0	1 33.3	6 100.0	3 100.0
Catholic							18 94.7	7 87.5	77 91.6	90 93.6	87 90.5	112 96.3	101 93.9	101 98.0	135 95.9	76 95.0	144 96.5	140 95.2	144 97.9	177 97.4	77 94.7	117 94.8	43 95.5	69 98.7	9 100.0	26 100.0	2 100.0	12 92.3
C. I.	8 100.0	4 100.0	18 100.0	17 85.0	9 100.0	17 89.4	5 100.0	2 100.0	13 100.0	1 100.0																		
C. I. W.	3 100.0	5 83.3	5 100.0	11 84.6	6 100.0	5 83.3	3 100.0	2 66.7	6 100.0	6 100.0	2 100.0	1 100.0																
Total for all schools	11 100.0	9 90.0	23 100.0	28 84.8	15 100.0	22 88.0	27 96.4	11 84.6	115 93.5	90 92.7	146 94.9	154 97.0	167 90.2	158 90.1	219 94.2	165 94.1	186 88.9	211 91.8	193 95.6	214 93.7	102 92.8	151 93.6	50 94.5	74 98.4	18 94.7	27 93.2	8 100.0	15 93.8
Total for both sexes	20 95.2		51 91.3		37 92.5		38 92.7		205 92.5		306 94.8		325 90.2		384 94.2		397 90.5		407 94.8		253 93.4		124 96.7		45 93.6		23 95.9	

TABLE NO. 55

Why were you made?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public													4	4	6	7	9	6	2	4	2	1						
													44.4	66.7	66.7	77.8	69.2	66.7	50.0	66.7	100.0	50.0						
P. Public							1		10	6	15	13	21	23	24	25	16	11	6	2	3	2						
							100.0		76.9	42.8	68.3	65.0	67.8	82.1	70.6	92.5	76.2	84.6	66.7	100.0	100.0	100.0						
G. Public									5	6	13	17	21	30	36	37	33	32	27	26	15	16	4	4	8	1	2	1
									62.5	50.0	68.4	78.3	55.2	66.6	72.0	61.8	60.1	56.9	64.3	70.2	68.3	89.0	50.0	80.0	80.0	33.3	33.3	33.3
Catholic							18	6	68	56	76	103	96	88	126	75	137	134	134	177	78	122	44	69	9	25	2	13
							94.7	75.0	83.6	87.4	81.3	88.5	89.3	87.1	89.5	93.8	91.8	91.2	91.1	97.4	95.9	98.8	100.0	97.7	100.0	100.0	100.0	100.0
C. I.	5	4	17	11	9	18	5	1	12	1																		
	83.3	100.0	94.5	55.0	100.0	94.7	100.0	50.0	92.3	100.0																		
C. I. W.	2	4	3	8	6	4	3	3	6	6	2	1																
	66.7	66.7	60.0	61.5	100.0	66.7	100.0	100.0	100.0	100.0	100.0	100.0																
Total for all schools	7	8	20	19	15	22	27	10	101	75	106	134	142	145	192	144	195	183	169	209	98	137	48	73	17	26	4	14
	63.6	80.0	87.0	57.6	100.0	85.0	93.2	83.3	83.8	77.3	78.4	84.4	76.7	81.2	82.6	82.1	81.7	83.4	83.7	85.3	90.2	95.9	92.2	97.1	89.4	92.8	50.0	87.5
Total for both sexes	15		39		37		37		176		240		287		336		378		378		235		121		43		18	
	71.4		69.8		92.5		90.3		80.8		80.9		79.5		82.3		82.8		76.7		93.8		95.6		91.6		75.0	

TABLE NO. 56

Who made you?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
													9	6	7	9	12	11	4	6	2	2						
S. Public													100.0	100.0	77.8	100.0	92.3	100.0	100.0	100.0	100.0	100.0						
							1		13	13	20	20	30	27	33	25	21	11	6	2	3	2						
P. Public							100.0		100.0	92.9	91.0	100.0	96.9	96.4	97.0	92.5	100.0	84.6	66.7	100.0	100.0	100.0						
									6	11	18	23	33	38	37	60	52	54	39	37	21	14	8	5	9	3	6	3
G. Public									75.0	91.6	94.7	100.0	86.8	84.4	74.0	100.0	94.6	94.5	92.8	100.0	91.4	100.0	100.0	100.0	90.0	100.0	100.0	100.0
							19	7	79	63	89	115	106	99	136	79	147	142	138	181	79	122	44	70	9	26	2	13
Catholic							100.0	100.0	98.8	98.3	97.0	98.9	98.6	99.0	97.9	100.0	98.5	99.2	93.8	99.6	97.2	98.8	100.0	100.0	100.0	100.0	100.0	100.0
	8	4	13	20	9	18	5	2	12	1																		
C. I.	100.0	100.0	72.3	100.0	100.0	94.7	100.0	100.0	92.3	100.0																		
	3	6	5	12	6	0	3	3	6	6	2	1																
C. I. W.	100.0	100.0	100.0	92.3	100.0	.0	100.0	100.0	100.0	100.0	100.0	100.0																
Total for	11	10	18	32	15	18	28	12	116	94	129	159	178	170	213	173	232	218	187	226	105	140	52	75	18	29	8	16
all schools	100.0	100.0	78.3	97.0	100.0	65.0	100.0	100.0	96.3	96.8	95.5	99.9	97.9	95.2	91.8	98.6	97.2	97.0	93.3	99.2	96.6	98.0	100.0	100.0	94.7	100.0	100.0	100.0
Total for	21		50		33		40		210		288		348		386		450		413		245		127		48		24	
both sexes	100.0		89.3		82.5		100.0		96.2		97.6		96.7		95.0		97.2		97.1		98.5		100.0		97.9		100.0	

Who made you? causes no difficulty in the minds of Catholic school children familiar as they are with the catechism question in this form. Their answer "God" does not cause much reflection, therefore, because it is almost automatic. The majority of the public school children give the same answer with more or less difficulty.[1] A number of children answer "My parents, or "My father,"—others apparently not able to overcome a sense of modesty leave the question unanswered. Either the mention of the Creator or of their pro-creator was considered a correct response to this question. (Table No. 56).

The next question, *From where do you think you came?,* inhibited the answers of many more children than did No. 5. The younger children answered "Heaven" or perhaps gave some false concept of their origin without questioning its authenticity. This is as we would expect. At 16 and above, the question was either answered frankly or left blank. A few attempts to evade the question by such answers as "Dust" or "Adam and Eve" were found. It is, however, in the adolescent period that the answers to this question are especially interesting. On this account Table No. 57, giving the absolute number and the percent of children for each answer, has been compiled.

TABLE NO. 57

From where do you think you came?

Age	10		11		12		13		14	
Sex	B	G	B	G	B	G	B	G	B	G
(Principle)										
	30	22	16	43	36	54	55	53	56	76
No answer	**10.1**	**22.7**	**10.7**	**25.1**	**21.2**	**27.0**	**24.1**	**29.2**	**24.2**	**34.0**
	9	7	13	14	16	19	30	13	30	13
I don't know	**7.0**	**7.2**	**8.6**	**4.0**	**9.5**	**9.5**	**13.1**	**7.2**	**10.8**	**9.9**
Heaven or	75	59	88	117	76	92	80	79	80	80
God	**58.5**	**60.8**	**58.1**	**34.0**	**44.8**	**46.0**	**35.0**	**43.5**	**34.6**	**35.8**
	1	0	3	4	9	4	25	13	27	10
Parents	**0.8**	**.0**	**2.0**	**1.2**	**5.3**	**2.0**	**11.0**	**7.2**	**11.7**	**4.5**
Any other	12	10	34	14	24	29	36	40	44	36
concept	**9.4**	**10.3**	**22.4**	**4.0**	**14.2**	**14.5**	**15.8**	**22.0**	**19.0**	**16.1**

A detailed consideration of the remaining questions given in

[1] The effort was apparent to the examiner as she watched various subjects puzzling over the question.

this group in the questionnaire will be considered in Chapter VII, "The Moral Problems of Childhood."

Group IV. The problems of this group resemble those of Group II in their general character but they are more difficult to solve.

The first three questions deal with the duty of the individual to do right even when the only censor of his act is his conscience. The children were not asked to answer "Why" to these questions and hence, no principles for their answers could be formulated. The questions read:

1. *Would it be wrong to say a swear word when no one is around?*

2. *Would it be wrong to take a nickel out of your mother's pocketbook without asking her?*

3. *Would a lie be a lie if no one ever found out you told it?*

The percentages of affirmative answers are given in the Tables No. 58, 59, and 60 below. Only affirmative answers to these questions were credited.

The power one has to influence the conduct of another by suggestion is a psychological fact, and the tendency to neglect a duty in the face of possible ridicule is a temptation most people feel at some time during life. An endeavor was made to combine these two points in the problem, *What should you do if a little boy or girl who never said any night prayers came to stay at your house for two or three nights, and got into bed before you have said your prayers?* As to power of suggestion the answers show that the question has practically none. And whatever may be the temptation in an actual situation, the presentation of the problem on paper offers none. The large percentage of children are agreed that they would say their prayers. This satisfies the obligation with the older children. At the lower ages, that is, up to about 12, the individual feels the further obligation of making his guest get out of bed and say his prayers. The recognition of the obligation to say his own prayers was considered a correct answer without concern as to what he felt his duty to be regarding his companion (Table No. 61).

TABLE NO. 58

Would it be wrong to say a swear-word when no one is around?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										2	2	3	10	6	10	8	17	9	5	9	3	3		2				
										100.0	66.7	100.0	90.9	100.0	90.0	88.9	100.0	75.0	83.4	90.0	100.0	100.0		100.0				
P. Public							1	0	13	14	21	19	30	28	32	27	18	12	9	2	3	2						
							100.0	.0	100.0	100.0	95.6	95.0	96.9	100.0	91.5	100.0	85.7	92.3	100.0	100.0	100.0	100.0						
G. Public									6	10	17	23	37	45	45	57	52	52	35	36	22	16	7	4	8	3	5	3
									75.0	83.3	89.4	100.0	92.3	100.0	90.0	93.5	74.6	93.1	87.5	100.0	100.0	100.0	87.5	100.0	80.0	100.0	83.4	100.0
Catholic							17	6	70	53	83	99	94	92	132	76	146	140	138	181	75	121	44	68	9	25	2	13
							100.0	85.7	95.9	99.9	97.1	95.0	90.2	95.7	95.0	95.0	99.3	95.2	95.2	97.7	95.3	96.8	100.0	97.2	100.0	100.0	100.0	100.0
C. I.	7	4	17	19	9	18	4	2	13	1																		
	87.5	100.0	94.5	100.0	100.0	100.0	80.0	100.0	100.0	100.0																		
C. I. W.	3	6	3	1	6	5	3	3	6	6	2	1																
	100.0	100.0	75.0	7.7	100.0	83.4	100.0	100.0	100.0	100.0	100.0	100.0																
Total for all schools	10	10	20	20	15	23	25	11	108	86	125	144	171	171	217	168	233	213	187	228	103	142	51	72	17	28	7	16
	90.9	100.0	91.0	62.6	100.0	95.9	96.3	91.6	95.0	96.3	95.0	96.5	92.3	97.5	93.5	94.1	96.7	96.1	93.5	98.0	98.9	96.6	97.9	97.2	89.4	100.0	87.5	100.0
Total for both sexes	20		40		38		36		194		269		342		385		446		415		245		123		45		23	
	95.2		74.0		97.3		94.7		96.0		95.5		95.4		94.3		95.9		95.9		98.0		97.2		95.7		95.9	

TABLE NO. 59

Would it be wrong to take a nickel out of your mother's pocket-book without asking her?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										2	2	3	10	6	10	9	16	5	4	5	1	1						
										100.0	66.7	100.0	90.9	100.0	90.9	100.0	94.1	100.0	80.0	83.4	100.0	100.0						
P. Public							1		13	14	21	19	31	27	32	26	21	12	9	2	3	2						
							100.0		100.0	100.0	95.6	95.0	100.0	94.4	91.5	96.2	100.0	92.3	100.0	100.0	100.0	100.0						
G. Public									7	11	16	23	36	44	48	61	55	54	38	36	22	15	7	4	10	3	6	3
									87.5	91.6	84.2	100.0	94.7	97.7	96.0	100.0	100.0	96.7	95.0	100.0	100.0	93.8	100.0	100.0	100.0	100.0	100.0	100.0
Catholic							17	6	73	54	82	101	101	95	136	78	147	145	145	183	79	119	42	68	9	25	2	13
							100.0	100.0	100.0	100.0	96.7	97.0	97.0	98.8	97.9	99.1	99.9	98.6	100.0	98.8	100.0	95.2	95.3	97.2	100.0	100.0	100.0	100.0
C. I.	7	4	17	19	9	18	5	3	13	1																		
	87.5	100.0	94.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0																		
C. I. W.	3	6	4	13	6	4	3	3	6	6	2	1																
	100.0	100.0	100.0	100.0	100.0	66.7	100.0	100.0	100.0	100.0	100.0	100.0																
Total for all schools	10	10	21	32	15	22	26	12	112	88	123	147	178	172	226	174	239	216	196	226	105	137	49	72	19	28	8	16
	90.9	100.0	95.6	100.0	100.0	91.7	100.0	100.0	98.6	98.6	93.5	97.0	96.1	98.0	97.0	99.2	99.2	97.6	98.0	98.5	100.0	94.5	96.0	97.2	100.0	100.0	100.0	100.0
Total for both sexes	20		53		37		38		200		270		350		400		455		422		242		121		47		24	
	95.2		98.1		94.7		100.0		99.0		95.9		97.0		97.6		97.8		99.2		97.3		96.8		100.0		100.0	

TABLE NO. 60

Would a lie be a lie if no one ever found out you told it?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										1	3	3	11	6	11	9	15	10	5	10	2	3		2				
										50.0	100.0	100.0	100.0	100.0	100.0	100.0	88.2	100.0	83.4	100.0	100.0	100.0		100.0				
P. Public							1		13	14	22	19	29	27	33	27	20	12	9	2	3	2						
							100.0		100.0	100.0	100.0	95.0	93.7	94.4	94.4	100.0	95.2	92.3	100.0	100.0	100.0	100.0						
G. Public									8	12	19	22	35	45	48	59	53	49	38	35	22	16	7	3	10	3	6	3
									100.0	100.0	100.0	95.7	89.6	100.0	96.0	95.6	96.5	89.2	95.0	97.3	100.0	96.8	100.0	100.0	100.0	100.0	100.0	100.0
Catholic							15	6	70	53	78	94	94	94	129	77	142	141	140	183	79	121	44	70	9	24	2	13
							88.2	100.0	97.3	99.9	92.0	90.2	90.2	97.8	92.9	97.8	96.6	95.9	96.6	96.8	100.0	96.8	100.0	100.0	100.0	96.0	100.0	100.0
C. I.	7	4	18	19	8	18	5	2	13	1																		
	87.5	100.0	100.0	100.0	88.9	100.0	100.0	100.0	100.0	100.0																		
C. I. W.	2	6	3	13	6	5	3	3	6	4	2	1																
	66.7	100.0	75.0	100.0	100.0	83.4	100.0	100.0	100.0	66.7	100.0	100.0																
Total for all schools	9	10	21	32	14	23	13	11	110	85	124	139	169	172	221	172	230	212	192	230	106	142	51	75	19	27	8	16
	81.8	100.0	95.6	100.0	93.4	95.9	95.2	100.0	99.7	95.2	99.6	91.7	91.3	98.0	94.1	96.3	95.5	94.6	96.0	98.0	100.0	96.6	100.0	99.0	100.0	69.4	100.0	100.0
Total for both sexes	19		53		37		24		195		263		341		393		442		422		248		126		46		24	
	90.4		98.1		94.7		92.4		97.5		93.4		94.1		95.9		95.0		97.0		98.2		99.5		98.0		100.0	

TABLE NO. 61

What should you do if a little boy or girl who never said any night prayers came to stay at your house for two or three nights, and got into bed before you have said your prayers?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										0	3	1	11	6	9	8	12	15	4	6	1	1						
										.0	100.0	100.0	100.0	100.0	81.8	88.9	75.0	100.0	80.0	100.0	100.0	100.0						
P. Public							1		12	13	18	19	27	27	28	27	19	10	8	2	2	2						
							100.0		92.3	92.8	81.9	95.0	87.2	96.4	80.1	100.0	90.4	76.9	88.9	100.0	66.7	100.0						
G. Public									6	9	18	22	28	38	40	53	45	46	25	28	20	12	4	4	9	3	3	2
									75.0	75.0	94.7	95.7	75.6	84.4	83.2	86.9	81.9	83.7	62.5	77.8	91.0	70.6	57.2	100.0	90.0	100.0	50.0	66.7
Catholic							17	6	64	48	69	85	86	90	128	72	140	138	136	177	75	119	41	70	8	25	2	13
							100.0	100.0	90.2	94.1	82.1	84.2	84.3	93.6	92.3	95.8	96.6	95.2	95.2	97.4	95.3	95.2	95.5	100.0	88.9	100.0	100.0	100.0
C. I.	8	4	17	16	9	18	5	2	13	1																		
	100.0	100.0	94.5	84.2	100.0	100.0	100.0	100.0	100.0	100.0																		
C. I. W.	3	5	2	11	6	6	3	3	6	4	2	1																
	100.0	83.4	50.0	91.6	100.0	100.0	100.0	100.0	100.0	66.7	100.0	100.0																
Total for all schools	11	9	19	27	15	24	26	12	102	75	110	128	142	161	205	160	216	209	173	213	98	133	45	74	17	28	7	15
	100.0	100.0	86.5	87.2	100.0	100.0	100.0	100.0	91.8	88.5	84.7	87.0	82.4	91.8	88.4	92.8	99.4	96.0	88.2	94.6	93.1	91.8	90.0	100.0	89.4	100.0	70.0	93.7
Total for both sexes	20		46		39		38		177		238		303		365		425		386		231		119		45		22	
	95.2		86.9		100.0		100.0		90.2		86.2		87.6		90.5		91.4		90.7		92.9		96.4		45.9		84.7	

TABLE NO. 62

What should you do if your mother scolded you very hard?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
(School)											2	0	5	4	8	6	5	3	4	3	1	1						
S. Public											66.7	.0	45.5	66.7	72.7	66.7	31.3	60.0	80.0	50.0	100.0	100.0						
							1		8	12	12	13	27	26	21	22	9	10	7	2	1	2						
P. Public							100.0		61.5	92.3	54.6	65.0	87.2	81.4	60.1	81.4	42.8	76.9	77.8	100.0	33.3	100.0						
									6	8	15	20	20	26	27	37	35	34	18	27	20	13	3	1	6	1	4	2
G. Public									75.0	66.6	78.9	87.0	52.6	57.7	56.2	60.7	64.8	61.9	45.0	75.1	91.0	75.0	42.9	50.0	60.0	33.3	66.7	75.0
							12	4	37	38	53	80	72	78	101	65	107	118	111	165	50	99	32	62	9	21	1	13
Catholic							70.6	80.0	55.1	79.1	63.6	80.8	71.3	82.7	72.7	85.8	73.8	81.4	77.7	90.8	64.0	79.2	72.6	88.7	100.0	86.0	50.0	100.0
	3	3	13	8	6	10	5	1	9	1																		
C. I.	37.5	75.0	72.3	42.1	66.7	55.6	100.0	50.0	69.2	100.0																		
	1	3	3	4	4	4	2	2	6	4	1	1																
C. I. W.	33.3	50.0	75.0	33.3	66.7	66.7	66.7	66.7	75.0	66.7	50.0	100.0																
Total for	4	6	16	12	10	14	20	7	66	63	83	114	124	134	157	130	156	165	140	197	72	115	35	63	15	22	5	15
all schools	36.4	60.0	72.8	38.8	66.7	58.4	77.0	70.0	60.7	78.8	64.7	77.5	68.2	77.7	67.7	75.4	66.5	75.7	71.4	87.0	67.7	79.4	68.6	87.6	78.9	78.5	62.5	93.8
Total for	10		28		24		27		129		197		258		287		321		337		187		98		37		20	
both sexes	47.6		52.9		61.4		75.1		68.4		71.5		72.8		70.9		70.9		79.9		74.6		79.4		78.8		83.4	

What should you do if your mother scolded you very hard? shows an interesting development in emotional control. The very young child will "Cry," later on he will "Pout" or "Get mad," still later he will "Go out" or "Forget it," at about 14 a number will "Forgive her," while at 15 a larger percent will "Take it as I deserve" or "Promise to do better." The number who take this rational view of the correction increases gradually throughout all the ages. Failure to appreciate the obligation to improve when corrected possibly indicates a lack of home training in this matter. Only an expressed appreciation of this obligation was credited as correct (Table No. 62).

What should you do if a playmate hit you without meaning to do so? This next question as stated previously, is taken from the Stanford Revision of the Binet-Simon Test, Year VIII. It illustrates our duty of charity and of forgiveness toward our neighbor when he accidentally causes us some inconvenience or suffering. An appreciation of this duty is given credit. This obligation is not appreciated by a large enough majority of the children at 6, 7 and 8 years to be considered a principle prevalent at these ages. At 9, however, it is, and the increase in those answering "Forgive him" or "Do nothing about it" after this age discloses an increased realization as one matures of his duty to his neighbor (Table No. 63).

The right of private property and the obligation of the individual to make reparation for damage done are involved in the question: *What should you do if your ball went through a neighbor's window?* At 9 there is a sudden awakening of the duty one has to fulfill this obligation to an injured party. Only the answer "To pay for the window" was considered correct for this question. The awakening of this duty as shown in story No. 7,[2] was also at 9 years (Table No. 64).

The child becomes aware of the fact that he is responsible for his misdemeanors and must not let others suffer for them at an early age. The question reads: *What should you do if while playing in the parlor you broke one of your mother's best chairs?*

[2] See p. 35.

TABLE NO. 63

What should you do if a playmate hit you without meaning to do so?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										1	2	1	10	6	9	8	13	5	4	4	1	1						
										100.0	66.7	33.3	90.9	100.0	81.8	88.9	81.2	100.0	80.0	66.7	100.0	100.0						
P. Public							1		11	11	15	18	30	26	28	25	18	12	8	2	3	2						
							100.0		84.6	78.5	68.3	90.0	96.9	81.4	80.1	92.6	85.7	92.3	88.9	100.0	100.0	100.0						
G. Public									4	10	15	21	29	35	42	53	46	48	32	33	22	16	6	2	7	2	5	3
									50.0	83.3	78.9	91.4	76.3	77.7	87.4	86.9	85.1	87.4	80.0	91.7	100.0	100.0	85.7	100.0	70.0	66.7	83.4	100.0
Catholic							15	3	55	44	65	87	78	81	118	65	131	128	132	173	72	114	40	68	9	25	2	13
							88.2	60.0	83.6	93.7	78.0	87.9	76.4	87.5	86.1	86.5	90.4	88.3	92.4	95.2	92.2	91.2	90.8	97.2	100.0	100.0	100.0	100.0
C. I.	6	2	11	12	7	12	4	1	12	1																		
	85.7	50.0	61.2	63.1	77.8	66.7	80.0	50.0	92.3	100.0																		
C. I. W.	2	3	2	7	6	3	3	3	6	4	2	1																
	66.7	50.0	50.0	58.3	100.0	50.0	100.0	100.0	100.0	66.7	100.0	100.0																
Total for all schools	8	5	13	19	13	15	23	7	88	71	99	128	147	148	197	151	208	193	176	212	98	133	46	70	16	27	7	16
	80.0	80.0	59.2	61.4	86.7	62.6	83.6	70.0	82.7	87.3	77.2	87.0	80.9	85.8	85.3	87.6	88.6	88.6	89.8	93.7	94.1	91.8	90.2	97.3	84.2	96.4	87.5	100.0
Total for both sexes	13		32		28		30		159		227		295		348		401		388		231		116		43		23	
	65.0		60.5		71.7		83.4		84.3		82.6		80.2		86.3		88.6		92.0		93.1		94.0		91.6		95.8	

TABLE NO. 64

What should you do if your ball went through a neighbor's window?

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
S. Public										1	3	1	10	6	7	7	15	5	4	6	1	1						
										50.0	100.0	100.0	90.9	100.0	63.6	77.8	93.8	100.0	80.0	100.0	100.0	100.0						
P. Public							1		12	13	19	19	30	26	32	24	21	12	8	2	2	2						
							100.0		92.3	92.8	86.5	95.0	96.9	92.8	91.5	88.8	100.0	92.3	88.9	100.0	66.7	100.0						
G. Public									5	8	6	21	24	28	36	46	51	47	26	31	20	12	5	2	7	1	5	2
									62.5	66.6	84.2	91.4	63.1	62.2	74.9	75.4	94.4	85.5	65.0	86.2	91.0	75.0	83.4	100.0	70.0	33.3	83.4	66.7
Catholic							15	4	48	40	66	83	82	82	120	69	130	134	138	170	72	120	40	69	8	25	2	13
							88.2	80.0	73.0	85.2	79.2	84.7	80.4	88.6	88.8	91.1	89.7	92.5	98.6	98.5	92.2	96.0	90.8	98.7	88.9	100.0	100.0	100.0
C. I.	7	2	12	10	5	9	5	1	11	1																		
	87.5	50.0	66.7	52.6	55.6	50.0	100.0	50.0	84.6	100.0																		
C. I. W.	2	2	1	5	3	4	3	2	6	4	1	1																
	66.7	33.3	25.0	41.7	50.0	66.7	100.0	66.7	100.0	66.7	50.0	100.0																
Total for all schools	9	4	13	15	8	13	24	7	82	67	105	125	146	142	195	146	217	198	176	209	95	135	45	71	15	26	7	15
	81.8	40.0	59.2	48.5	53.4	54.2	92.4	70.0	77.1	81.7	81.9	87.5	80.3	82.4	84.8	84.7	92.4	90.9	89.8	96.3	91.2	93.2	91.8	98.7	83.4	92.8	87.5	93.8
Total for both sexes	13		28		21		31		149		230		288		341		415		385		230		116		41		22	
	61.9		52.9		53.8		86.2		79.0		84.6		78.3		84.6		91.7		93.6		92.7		96.3		89.0		91.7	

TABLE NO. 65

What should you do if while playing in the parlor you broke one of your mother's best chairs? (No one saw you break it and your brother was blamed for doing it.)

Age	6		7		8		9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
										1	3	1	11	6	10	8	15	5	4	6	1	1						
S. Public										50.0	100.0	100.0	100.0	100.0	90.9	88.9	93.8	100.0	80.0	85.7	100.0	100.0						
								1	12	14	21	19	30	27	35	26	19	12	7	2	2	2						
P. Public								100.0	92.3	100.0	95.6	95.0	96.9	96.4	100.0	96.2	90.4	92.3	77.8	100.0	66.7	100.0						
									7	12	19	21	31	38	45	58	48	49	35	31	21	14	6	2	9	3	6	3
G. Public									87.5	100.0	100.0	91.4	81.5	84.4	93.6	95.1	88.8	89.2	87.5	86.2	100.0	87.5	100.0	100.0	90.0	100.0	100.0	100.0
							16	4	56	45	68	91	81	89	127	72	136	136	137	181	70	122	44	70	9	25	2	13
Catholic							94.1	80.0	86.3	94.9	81.6	93.7	80.2	96.1	94.0	95.0	96.6	93.8	95.9	99.6	89.6	97.6	100.0	100.0	100.0	100.0	100.0	100.0
	8	3	18	16	9	17	5	1	13	1																		
C. I.	100.0	75.0	100.0	84.2	100.0	94.5	100.0	100.0	100.0	100.0																		
	1		1	10	6	4	3	3	6	4	2	1																
C. I. W.	33.3		33.3	83.3	100.0	66.7	100.0	100.0	100.0	80.0	100.0	100.0																
Total for	9	3	19	26	15	21	24	9	94	77	113	133	153	160	217	164	218	202	183	220	94	139	50	72	18	28	8	16
all schools	81.8	75.0	86.5	84.0	100.0	87.6	96.0	90.0	89.3	94.7	88.1	93.1	84.2	92.8	94.4	95.1	94.6	92.5	93.3	97.0	91.2	95.9	100.0	100.0	94.7	100.0	100.0	100.0
Total for	12		45		36		33		171		246		313		381		420		403		233		122		46		24	
both sexes	80.0		85.1		92.2		94.4		92.3		90.8		88.9		94.5		93.7		95.5		94.4		100.0		98.0		100.0	

(*No one saw you break it and your brother was blamed for doing it.*) Very often when a child answered "I would say nothing" his reason revealed the fear he had of punishment. For instance, one child answered "I wouldn't say a thing. I would let him get the licking." In such a case punishment has had exactly the opposite effect on the character of the child to that desired. The motive of fear is probably the greatest impediment to a sense of honor among children. No credit was given for this question unless the child felt that the obligation to admit his guilt without being forced to do so, was incumbent upon him (Table No. 65).

Group V was given in the following form:

Draw a line under each word in the list below which indicates a trait of character you would like to possess.

gloomy	*obedient*	*conceited*	*frank*
humble	*foolish*	*deceitful*	*flirt*
aggressive	*simple*	*lazy*	*patriotic*
careless	*thief*	*sincere*	*insulting*
loving	*polite*	*charitable*	*generous*
shrewd	*affected*	*vain*	*loyal*
dissipated	*neatness*	*liar*	*proud*
friendly	*insolent*	*extravagant*	*quarrelsome*
modest	*wicked*	*dishonest*	*patient*
immoral	*self-respecting*	*stubborn*	*cautious*
sullen	*pliable*	*peaceful*	*indecent*
cheerful	*impudent*	*sneak*	*honest*

There are in this list twenty-one desirable traits, if we include "simple." In scoring this question the number of correct traits answered by each subject was counted and the median number for each age was evaluated from these records. This median was evaluated separately for each school system and the average median given below was attained by taking the average of the medians of the different schools. There are three school systems represented in this record, the P. Public, the G. Public and the Catholic.

Age	9	10	11	12	13	14	15	16	17	18	Ad.
Median Number of Traits	6.0	10.8	12.2	14.0	14.2	14.5	13.9	15.2	16.3	17.3	16.7

In Group VI we desire to find at what age children become aware of certain faults being more serious than others. This end is attained by placing before the children groups of five words each. In each Group there is one word which designates an action or a moral character much worse than any of the others. The child is then asked to cross out that word which is worst. We may assume that when the child does not cross out the correct word he does not know its value in relation to the group in which it is placed.

The list of words given is as follows:

In each of the following lines cross out the word that is worst.
Example (1) *begging, lying, smoking, murder, cheating.*
Example (2) *dullness, foolishness, laziness, slowness, pity.*

1	*fighting*	*borrowing*	*charity*	*killing*	*dislike*
2	*dancing*	*flirting*	*obedience*	*adultery*	*smoking*
3	*holiness*	*cruelty*	*kindness*	*haste*	*slang*
4	*frankness*	*disloyalty*	*shrewdness*	*vanity*	*bigamy*
5	*rudeness*	*meekness*	*gossip*	*slander*	*hesitancy*
6	*bullying*	*insult*	*black-mail*	*tattling*	*scolding*
7	*flattery*	*lying*	*fibbing*	*frank*	*insincere*
8	*love*	*hate*	*fondness*	*dislike*	*liking*
9	*courtesy*	*pleasantness*	*friendliness*	*gentleness*	*timidity*
10	*stinginess*	*carefulness*	*generosity*	*charity*	*economy*

In line No. 1 "killing" is recognized as worst by a sufficient majority, that is 75 percent of the 13-year-olds, to let us assume that it is a fair test for the average child at that age (Table No. 66).

In line No. 2 the test given to the public school children reads as printed above. Results for this are listed under P. Public and G. Public in Table No. 67 below. It will be noted that the word "adultery" was too difficult for all children to whom the test was given in the P. Public schools and was not passed until year 17 in the G. Public schools. Children, therefore, before the age of 17 do not know the meaning of "adultery" nor its relative value from the moral standpoint. The word "adultery" was changed to "idolatry" before the tests were given to the parochial school children. Children differentiate the relative value of "idolatry" at 15. This record is given under *Catholic* school in the Table below.

TABLE NO. 66

Line No. 1

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public	1 100.0		5 41.7	7 50.0	13 68.4	8 42.1	16 52.8	15 60.0	27 79.4	13 50.0	12 66.7	7 58.3	4 50.0	1 50.0	0 .0	2 100.0						
G. Public			4 57.2	6 50.0	12 66.7	18 78.3	19 51.3	27 59.9	35 71.4	36 60.8	32 64.0	28 60.8	30 78.9	21 61.7	30 71.4	13 65.0	7 58.3	5 62.5	4 80.0	5 62.5	5 83.3	2 100.0
Catholic	10 71.4	2 40.0	31 63.2	16 34.7	52 66.6	59 66.1	81 85.9	72 80.6	115 87.4	69 91.8	131 91.7	126 88.2	130 89.7	169 99.7	72 92.2	116 94.0	41 95.5	69 98.7	9 100.0	24 100.0	2 100.0	13 100.0
C. I.				1 100.0																		
C. I. W.	3 100.0	1 100.0			2 100.0	1 100.0																
Total for all schools	14 77.9	3 50.0	40 58.9	30 47.7	79 67.2	86 65.4	116 71.9	114 71.8	177 82.8	118 74.3	175 83.1	161 80.0	200 88.2	191 88.8	102 86.7	131 89.1	48 87.4	74 94.7	13 92.8	29 90.8	7 87.5	15 100.0
Total for both sexes	17 70.9		70 53.2		165 66.2		230 71.9		295 78.5		336 99.1		391 88.7		233 88.1		122 91.5		42 91.1		22 95.7	

TABLE NO. 67

Line No. 2

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public (Adultery)			2 18.2	4 28.6	7 36.8	4 22.2	10 33.3	8 32.0	16 47.1	5 19.3	6 33.4	4 33.3	1 12.5	0 .0	0 .0	2 100.0						
G. Public (Adultery)			1 16.7	2 16.7	8 44.5	12 52.2	23 35.1	13 28.9	18 36.7	32 37.2	19 38.0	15 32.6	31 81.5	19 55.9	16 57.1	12 60.0	10 83.3	5 62.5	4 80.0	5 62.5	5 83.3	2 100.0
Catholic (Idolatry)	4 28.6	0 .0	16 32.6	12 26.6	19 24.3	39 43.7	51 55.1	48 54.7	96 73.0	50 66.5	104 72.8	108 75.6	116 80.0	149 87.9	66 84.5	110 89.1	36 83.9	63 90.1	9 100.0	21 87.6	2 100.0	13 100.0

TABLE NO. 68
Line No. 3

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public			4	7	11	5	20	12	28	13	9	3	5	1	0	1						
			36.4	53.8	57.9	27.8	66.7	48.0	92.3	50.0	50.0	25.0	62.5	50.0	.0	50.0						
G. Public			0	3	10	11	15	18	25	34	28	23	29	17	18	12	9	5	3	6	5	1
			.0	25.0	55.6	47.9	40.5	40.0	51.0	57.5	56.0	49.9	76.3	50.0	64.3	60.0	75.0	62.5	60.0	75.0	83.4	50.0
Catholic	5	2	22	13	34	48	54	57	88	59	104	104	117	156	62	111	37	61	9	22	2	12
	35.7	40.0	48.8	25.2	43.5	54.7	58.9	65.0	66.9	78.5	73.8	72.8	80.7	92.0	79.4	91.0	86.2	87.2	100.0	91.7	100.0	92.3
Total for all schools	5	2	26	23	55	64	89	87	141	109	141	130	150	174	80	124	46	66	12	28	7	13
	35.7	40.0	41.3	38.9	47.9	50.2	56.1	55.1	66.7	69.2	67.4	65.0	79.5	82.7	74.4	85.6	83.7	84.5	80.0	87.6	87.5	86.7
Total for both sexes	7		49		119		176		250		271		324		204		112		40		20	
	36.8		40.2		48.8		56.7		66.5		66.4		81.6		80.6		84.0		85.2		87.0	

TABLE NO. 69
Line No. 4

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public			0	11	3	1	6	5	11	7	6	2	1	1	0	2						
			.0	84.6	15.8	5.6	20.0	20.9	32.3	27.0	33.4	16.7	12.5	50.0	.0	100.0						
G. Public			1	1	5	10	7	16	12	11	21	11	18	14	12	8	5	4	3	3	4	2
			14.3	8.3	27.8	43.5	19.5	32.6	24.5	18.6	42.0	23.9	17.3	41.2	44.4	40.0	41.7	50.0	60.0	37.5	66.7	100.0
Catholic	4	0	11	5	17	23	35	43	74	35	90	88	97	129	59	99	33	59	9	19	2	13
	28.6	.0	24.4	15.7	21.8	26.2	38.2	49.0	56.2	46.6	63.0	61.6	67.9	76.1	75.5	81.2	76.9	84.4	100.0	79.2	100.0	100.0
Total for all schools	4	0	12	17	25	34	48	64	97	53	117	101	116	144	71	109	38	63	12	22	6	15
	28.6	.0	19.1	29.8	27.8	26.4	30.4	39.2	45.3	33.1	55.7	50.5	61.5	67.0	66.4	75.8	69.2	80.6	85.7	68.9	75.0	100.0
Total for both sexes	4		29		59		112		150		218		260		180		101		34		21	
	21.0		24.1		26.9		34.9		40.0		53.6		64.5		71.6		75.8		73.8		91.4	

TABLE NO. 70
Line No. 5

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public			1	3	8	3	9	6	14	11	6	5	2	1	0	2						
			9.1	23.1	42.1	16.7	27.7	24.0	41.2	42.4	33.4	41.6	25.0	50.0	.0	100.0						
G. Public			2	1	5	5	7	7	12	18	24	14	17	11	12	11	6	4	3	2	3	0
			28.6	8.3	27.8	21.8	18.9	15.2	24.5	30.4	48.0	30.4	44.7	32.3	44.4	55.0	50.0	50.0	75.0	25.0	50.0	.0
Catholic	4	1	4	5	23	29	36	28	73	38	103	86	73	116	52	80	36	46	6	23	1	12
	28.6	20.0	8.9	15.7	29.4	33.1	39.2	31.9	55.5	48.5	74.2	60.2	51.1	68.4	67.6	65.6	83.9	65.8	66.7	95.9	50.0	92.3
Total for all schools	4	1	7	9	38	37	52	41	99	67	133	105	92	128	64	93	42	50	9	25	4	12
	28.6	20.0	11.1	15.8	31.3	28.7	32.8	25.8	46.2	41.7	64.1	52.5	46.5	59.5	60.2	64.6	76.4	64.0	69.2	78.3	50.0	80.0
Total for both sexes	5		16		73		93		166		238		220		157		92		34		16	
	26.3		13.3		29.9		29.3		44.2		58.1		54.6		62.8		69.0		72.4		69.6	

TABLE NO. 71
Line No. 6

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public			4	5	7	4	11	8	20	12	10	6	2	0	0	2						
			36.4	35.7	36.8	50.0	36.3	32.0	58.8	46.2	55.6	50.0	25.0	.0	.0	100.0						
G. Public			4	4	8	11	18	12	28	24	26	32	21	15	13	12	6	4	1	3	4	1
			57.2	33.3	44.5	47.9	48.6	26.0	47.3	40.6	52.9	47.8	55.2	44.1	46.4	60.0	50.0	50.0	25.0	37.5	66.7	50.0
Catholic	8	0	22	8	38	35	57	56	91	51	112	99	113	140	62	99	31	60	7	13	2	13
	57.1	.0	49.9	25.0	48.6	39.9	62.1	63.8	69.2	67.8	78.4	70.3	80.2	82.6	79.4	81.2	72.2	85.8	77.8	75.1	100.0	100.0
Total for all schools	8	0	30	17	53	50	86	76	139	87	148	127	136	155	75	113	37	64	8	21	6	14
	57.1	.0	48.3	29.2	46.1	38.8	54.2	47.9	62.0	54.4	70.4	63.5	72.1	72.1	69.8	78.5	67.3	81.9	61.5	65.7	75.0	93.4
Total for both sexes	8		47		103		318		226		276		291		188		101		29		20	
	42.1		39.0		42.2		51.0		59.0		67.6		72.5		74.4		75.8		64.4		87.0	

The third list of words is comparatively simple if we consider the meaning of the words. But evidently children have difficulty in differentiating their relative values because they do not pass the 75 percent mark until year 15 (Table No. 68).

Bigamy is not recognized as the worst word of those given in line No. 4 until the 17-year-old group is reached (Table No. 69).

In line No. 5 the test is approximately passed in year 18. The relative seriousness of gossip and slander as actions contrary to the moral law is not, however, clearly defined until adult years (Table No. 70).

Blackmail is considered the worst action of the group in which it is placed by 75 percent of the children at 17. This is probably a fair test for children of 16, when we consider that it practically reaches 75 per cent at that age (Table No. 71).

Lying is not differentiated by 75 percent of the children in the group of any age. It may, perhaps, be considered an 18 year-old test. The low percentage in the 18-year-old group is probably accidental (Table No. 72).

Hate is recognized as the worst action in its Group, line No. 8, at age 13 (Table No. 73).

This list in which timidity is the worst word, was felt by the examiner to lack sufficient moral differentiation to enable the child to pick it out. Table No. 74 for line No. 9 shows that at 18 the 75 percent mark is practically reached. Had a stronger word such as cowardice been used instead of timidity, the results would probably have been more definite. However, we may consider this a fair test for year 18.

Stinginess is differentiated as the worst word in its Group by the 13-year-olds. A phenomenon which occurs quite frequently, namely that the 14-year-old group falls below the point attained by the 13-year-old, is exemplified very well in Table No. 75.

This group of tests may be used in a standarized scale of Moral Tests to measure the ability of the individual to differentiate moral qualities. No credit is given for any differentiation except that which recognizes the one word which is absolutely the

TABLE NO. 72
Line No. 7

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
			4	8	11	4	13	10	17	9	10	4	3	1	0	1						
P. Public			36.4	57.1	57.9	22.2	42.9	40.0	50.0	34.7	55.6	25.3	37.5	50.0	.0	50.0						
			4	3	4	13	15	25	30	27	27	17	19	17	16	14	7	5	4	5	2	1
G. Public			57.2	25.0	22.2	56.6	41.7	55.5	61.2	45.6	54.0	37.0	51.3	50.0	57.1	70.0	58.3	62.5	80.0	62.5	33.3	50.0
	5	1	18	11	43	32	53	43	70	42	85	79	85	111	55	95	30	51	8	16	2	10
Catholic	35.1	20.0	40.9	34.4	55.0	36.8	57.8	49.6	53.2	55.9	59.5	56.1	59.5	65.5	70.4	78.9	69.9	72.9	88.9	66.8	100.0	76.9
Total for	5	1	26	22	58	49	81	78	117	78	122	100	107	129	71	110	37	56	12	21	4	11
all schools	35.2	20.0	29.1	37.8	50.5	38.2	51.0	49.1	54.8	49.1	58.1	50.0	56.7	60.1	66.0	71.5	67.3	71.7	85.7	65.7	50.0	73.4
Total for	6		48		107		159		195		222		236		181		93		33		15	
both sexes	31.6		32.6		44.1		50.4		52.1		54.4		58.8		69.3		69.8		71.6		65.3	

TABLE NO. 73
Line No. 8

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
			3	9	12	6	21	13	28	14	11	4	5	0	0	2						
P. Public			27.3	69.2	63.1	33.4	69.3	52.0	82.3	53.9	61.2	33.3	62.5	.0	.0	100.0						
			3	7	9	14	15	26	26	56	37	28	28	22	20	13	9	7	4	6	5	2
G. Public			42.9	58.3	50.0	60.9	41.7	57.7	54.1	94.6	66.2	60.8	75.6	64.7	71.4	65.0	75.0	87.5	80.0	75.0	83.4	100.0
	6	3	25	15	43	54	62	67	103	63	117	124	116	159	63	107	31	63	9	21	2	13
Catholic	42.8	60.0	56.8	47.0	55.0	62.1	67.6	76.4	78.3	83.8	83.1	88.0	81.2	93.8	81.9	88.8	93.9	90.1	100.0	87.6	100.0	100.0
Total for	6	3	31	31	64	74	98	106	157	133	165	156	149	181	83	122	40	70	13	27	7	15
all schools	42.8	60.0	49.9	54.3	55.7	57.7	61.7	66.8	73.8	83.8	76.9	79.6	79.0	84.3	77.2	85.4	88.8	91.0	92.9	84.5	87.5	100.0
Total for	9		62		138		204		290		321		330		205		110		40		22	
both sexes	47.3		52.1		56.9		64.7		77.7		77.7		81.8		82.0		90.2		86.8		95.7	

TABLE NO. 74
Line No. 9

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public			0	6	4	5	12	10	18	14	7	4	4	0	1	1						
			.0	46.1	21.0	27.8	39.6	40.0	52.9	53.9	38.9	33.3	50.0	.0	50.0	50.0						
G. Public			2	4	8	12	9	19	30	23	24	21	26	16	19	9	7	4	1	5	5	0
			28.6	33.3	44.5	52.2	24.3	42.2	60.0	49.9	61.4	45.6	70.2	47.0	67.8	45.0	58.3	50.0	50.0	62.5	83.3	.0
Catholic	3	0	11	6	24	29	33	43	67	40	72	81	95	116	46	40	28	58	7	20	1	2
	21.4	.0	25.0	18.8	30.7	33.4	36.0	49.0	50.9	54.0	50.4	57.5	66.5	68.4	60.7	74.7	68.3	82.9	77.8	83.4	50.0	15.4
Total for all schools	3	0	13	16	36	46	54	72	115	77	103	106	125	132	66	100	35	62	8	25	6	2
	21.4	.0	21.7	28.0	31.3	35.9	34.0	45.4	53.4	52.4	49.2	50.0	66.3	61.5	62.0	70.0	63.7	79.4	88.9	75.8	75.0	13.3
Total for both sexes	3		29		82		126		192		209		257		166		97		32		8	
	15.8		24.7		33.7		39.8		53.1		49.7		64.0		66.9		72.8		74.6		34.8	

TABLE NO. 75
Line No. 10

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public			4	5	13	13	23	19	26	18	12	7	4	1	1	2						
			44.4	38.5	68.4	72.3	75.9	70.0	76.4	69.3	66.7	58.3	80.0	50.0	50.0	100.0						
G. Public			4	8	8	13	18	24	40	33	32	29	29	25	22	18	11	8	4	6	5	2
			57.2	66.7	44.5	56.6	48.6	53.3	80.0	71.6	81.9	59.2	78.3	73.5	78.5	90.0	91.6	100.0	80.0	100.0	62.5	100.0
Catholic	6	2	20	17	35	50	54	60	99	64	112	116	128	167	70	114	43	68	9	24	2	10
	42.8	40.0	46.6	53.2	44.8	57.5	58.9	69.0	75.2	85.1	78.4	82.4	89.6	98.5	93.4	94.6	100.0	97.2	100.0	100.0	100.0	76.9
Total for all schools	6	2	28	28	56	76	95	103	165	115	156	152	161	193	93	134	54	76	13	30	7	12
	42.8	40.0	47.3	51.0	48.7	59.3	60.0	65.9	76.9	78.2	74.6	72.0	86.9	89.9	87.4	93.8	98.3	97.3	92.9	100.0	87.5	80.0
Total for both sexes	8		56		132		198		280		308		354		227		130		43		19	
	42.1		49.3		54.3		62.8		77.8		73.3		88.5		91.3		97.5		97.6		82.7	

Group VII. The first four tests in this group treat of the similarity of two moral concepts which are in general dissimilar. The question reads:

In what way are these things alike:

(*a*) *Disobedience* *Stealing*	(*c*) *Angel* *Baby*
(*b*) *Swearing* *Praying*	(*d*) *God* *Your soul*

An examination of Table No. 76 below shows that (a) is not passed by 75 percent of the 16-year-olds but is passed by this percentage of 17-year-olds. In Table No. 77, (b) 75 percent is reached by the 18-year-old group. In Table No. 78, (c) this percentage is reached by the 16-year-old group. In Table No. 79, (d) 75 percent is again reached by the 17-year-old group.

The second division of this Group asks the subject to tell "In what way are these things different":

(*e*) *Saint* *Sinner*	(*g*) *Lying* *Cheating*
(*f*) *God* *Man*	(*h*) *Love* *Hate*

(*i*) *Selfishness*
Gratitude

Table No. 80 which gives the results for question (e) shows this test is passed by the 15-year-old group with a percentage considerably over 75.

Table No. 81 which gives the results for question (f) shows that this test also belongs to the 15-year group.

Question (g) is doubtful even as a fair test at 18 years, because it does not quite reach the 75 percent limit. However, were there enough cases at adult age it would undoubtedly be found that the test would belong to that period, and it has on this account been placed in the adult age group. These results are given in Table No. 82.

Table No. 83 which gives the result from question (h) reaches 75 percent at the age of 17 and is considered a fair test for that age.

In Table No. 84 which gives the results for question (i) 75 percent is again reached at 17.

TABLE NO. 76
Line (a)

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public					0		0		1													
					.0		.0		100.0													
G. Public			1	0	4	3	4	10	8	17	12	11	17	11	11	9	5	4	4	2	1	0
			20.0	.0	28.6	18.8	11.1	24.4	24.2	38.6	31.6	33.3	53.2	47.9	39.3	50.0	83.4	80.0	66.7	66.7	33.3	.0
Catholic	0	0	13	3	15	18	17	27	47	24	53	60	52	86	35	74	35	52	9	18	2	9
	.0	.0	29.5	17.6	26.3	35.3	22.4	41.0	42.8	35.8	47.7	46.8	47.3	54.2	53.9	59.9	83.3	74.4	100.0	85.7	100.0	90.0
Total for all schools			14	3	19	21	21	37	56	41	65	71	69	97	46	83	40	56	13	20	3	9
			28.6	12.5	26.0	31.3	18.7	34.8	38.6	36.9	43.6	44.0	48.3	53.4	49.7	63.1	.83.2	74.5	86.7	83.4	60.0	81.8
Total for both sexes	0		17		40		58		97		136		166		129		96		33		12	
	.0		23.3		28.4		26.6		37.9		44.5		51.3		57.5		76.8		84.5		75.0	

TABLE NO. 77
Line (b)

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public					0				1													
					.0				100.0													
G. Public			0	0	0	0	14	5	5	3	6	5	7	4	7	4	2	2	5	0	0	0
			.0	.0	.0	.0	53.9	12.2	15.7	7.3	15.8	15.2	31.9	18.2	38.9	22.2	33.3	50.0	83.4	.0	.0	.0
Catholic	1	0	4	0	6	6	3	15	16	12	20	57	26	66	31	74	32	48	8	16	2	6
	10.0	.0	9.6	.0	10.7	12.5	4.1	24.2	15.2	18.2	18.8	43.0	24.2	42.2	47.7	59.9	74.6	68.6	88.9	80.0	100.0	60.0
Total for all schools	1	0	4	0	6	6	17	20	22	15	26	62	33	70	38	78	34	50	13	16	2	6
	10.0	.0	8.7	.0	9.4	18.3	17.0	19.2	15.8	14.0	17.9	39.1	25.4	38.5	45.6	64.7	69.4	67.5	86.7	72.8	40.0	54.5
Total for both sexes	1		4		12		37		37		88		103		116		84		29		8	
	8.3		5.5		8.9		18.1		15.1		29.0		33.2		56.8		68.0		78.3		50.0	

TABLE NO. 78
Line (c)

Age Sex (School)	9 B	G	10 B	G	11 B	G	12 B	G	13 B	G	14 B	G	15 B	G	16 B	G	17 B	G	18 B	G	Ad. B	G
P. Public					0 .0				0 .0													
G. Public			1 25.0	0 .0	3 42.9	1 6.3	4 13.2	13 31.7	10 34.5	10 24.4	15 39.5	6 18.2	8 40.0	8 36.4	7 38.9	6 40.0	4 66.7	4 100.0	2 33.3	1 50.0	3 100.0	0 .0
Catholic	0 .0	0 .0	7 17.1	3 18.8	7 13.0	10 20.8	20 27.0	27 43.5	53 50.4	35 53.9	61 59.8	77 61.6	72 67.0	124 78.1	44 68.6	102 82.6	38 90.4	59 84.4	8 88.9	16 80.0	2 100.0	7 70.0
Total for all schools	0 .0	0 .0	8 17.8	3 13.1	10 14.5	11 17.2	24 23.1	40 38.8	63 46.6	45 42.3	76 54.0	83 52.3	80 62.4	132 73.9	51 62.2	108 84.2	42 87.4	63 85.1	10 66.7	17 77.4	5 100.0	7 63.6
Total for both sexes	0 .0		11 16.2		21 15.8		64 30.8		108 44.6		159 53.3		212 68.9		159 75.7		105 86.1		27 72.9		12 75.0	

TABLE NO. 79
Line (d)

Age Sex (School)	9 B	G	10 B	G	11 B	G	12 B	G	13 B	G	14 B	G	15 B	G	16 B	G	17 B	G	18 B	G	Ad. B	G
P. Public					1 100.0				0 .0													
G. Public			0 .0	1 14.3	0 .0	0 .0	6 19.8	6 14.6	3 10.4	4 9.8	10 26.3	11 35.5	10 50.0	3 15.0	7 38.9	7 46.7	4 80.0	2 50.0	4 66.7	1 50.0	1 33.3	0 .0
Catholic	3 33.3	0 .0	6 15.4	1 9.1	13 24.1	11 24.4	22 31.5	30 48.3	44 42.7	34 57.7	51 50.0	69 56.6	58 55.1	111 72.2	39 60.8	86 77.4	39 92.8	55 78.7	8 100.0	18 90.0	2 100.0	8 80.0
Total for all schools	3 33.3		6 14.0	2 12.5	14 20.3	11 18.0	28 28.0	36 35.0	47 35.3	38 36.9	61 43.3	80 52.0	68 54.4	114 65.0	46 56.1	93 73.5	43 91.6	57 77.0	12 85.7	19 86.5	3 60.0	8 72.7
Total for both sexes	3 27.3		8 13.5		25 19.3		64 31.6		85 36.1		141 48.1		182 61.0		139 66.7		100 83.0		31 86.2		11 68.8	

TABLE NO. 80
Line (e)

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
					1				1													
P. Public					100.0				100.0													
			2	2	8	6	11	15	15	17	23	15	17	16	11	12	5	4	3	2	3	1
G. Public			50.0	28.6	57.1	26.1	36.3	36.6	53.6	43.5	60.5	51.8	85.0	76.2	61.2	80.0	100.0	100.0	50.0	100.0	100.0	100.0
	0	0	17	5	22	22	29	35	88	44	69	90	89	136	58	104	40	68	8	18	1	10
Catholic	.0	.0	43.5	50.0	42.2	53.7	43.2	53.9	82.7	68.6	68.3	72.9	80.1	87.0	86.4	92.6	95.2	97.2	100.0	90.0	50.0	100.0
Total for	0	0	19	7	31	28	40	50	104	61	92	105	106	152	69	116	45	72	11	20	4	11
all schools	.0	.0	44.3	41.2	46.2	46.7	41.2	47.0	77.0	59.2	66.2	69.3	81.6	85.1	81.4	91.6	95.9	97.2	78.5	91.0	80.0	100.0
Total for	0		26		59		90		165		197		258		185		117		31		15	
both sexes	.0		43.4		44.8		44.4		69.3		68.0		84.1		87.3		97.1		86.2		93.8	

TABLE NO. 81
Line (f)

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
					0				1													
P. Public					.0				100.0													
			1	1	3	5	12	11	12	13	22	19	11	14	13	8	3	2	4	2	3	
G. Public			25.0	14.3	23.1	21.8	39.6	26.8	42.8	33.3	57.9	65.6	55.0	66.7	65.0	53.4	60.0	66.7	66.7	100.0	100.0	
	3	0	14	2	18	16	25	34	74	47	71	78	86	126	52	96	40	68	8	19	1	7
Catholic	42.9	.0	35.8	20.0	34.6	40.0	39.8	55.8	76.2	77.1	73.1	66.3	81.7	84.4	81.1	88.3	97.6	97.2	100.0	100.0	50.0	70.0
Total for	3	0	15	3	21	21	37	45	87	60	93	97	97	140	65	104	43	70	12	21	4	7
all schools	42.9	.0	35.0	17.6	31.9	33.4	40.0	44.1	60.0	68.7	68.8	66.0	77.6	82.6	77.4	84.2	93.3	95.9	85.7	100.0	80.0	70.0
Total for	3		18		42		82		147		180		237		169		113		33		11	
both sexes	25.0		30.1		32.8		41.8		64.8		64.1		80.3		81.1		94.9		94.4		73.4	

TABLE NO. 82
Line (g)

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public					0				1													
					.0				100.0													
G. Public			0	0	1	0	9	8	1	2	6	3	7	1	11	5	3	0	3	1	1	
			.0	0	7.7	.0	29.7	19.5	3.6	5.1	15.8	10.4	35.0	5.0	57.9	33.3	60.0	.0	50.0	50.0	50.0	
Catholic	0	0	0	0	3	4	4	8	8	2	34	48	34	29	29	65	32	53	8	14	1	8
	.0	0	.0	0	5.9	10.2	6.4	13.8	9.1	3.4	37.7	41.8	33.7	20.3	45.2	60.5	78.1	75.8	100.0	73.6	50.0	80.0
Total for all schools	0	0	0	0	4	4	13	16	10	4	40	51	41	30	40	70	35	53	11	15	2	8
	.0	0	.0	0	6.2	7.3	14.0	16.2	8.5	4.1	31.2	35.2	34.0	18.3	48.0	56.7	76.0	72.6	78.5	71.4	50.0	80.0
Total for both sexes	0		0		8		29		14		91		71		110		88		26		10	
	.0		.0		6.6		15.1		8.5		33.5		25.0		53.4		73.9		74.4		71.4	

TABLE NO. 83
Line (h)

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public					0				1													
					.0				100.0													
G. Public			5	2	7	6	14	14	8	14	23	16	11	11	10	9	2	2	1	1	1	
			71.5	50.0	53.8	37.5	46.2	34.2	29.6	35.8	60.5	55.2	55.0	55.0	52.6	53.4	40.0	66.7	20.0	50.0	50.0	
Catholic	1	0	6	0	12	12	11	24	46	27	52	79	57	99	40	82	38	61	7	12	1	10
	14.3	.0	15.4	.0	23.5	30.0	17.5	41.3	54.3	49.1	59.3	68.7	59.3	69.3	54.8	76.3	95.0	87.2	87.5	63.1	50.0	100.0
Total for all schools	1	0	11	2	19	18	25	38	55	41	75	95	68	110	50	91	40	63	8	13	2	10
	14.3	.0	23.9	14.3	29.3	32.2	27.0	38.4	48.4	43.5	59.3	65.6	58.5	68.2	61.0	73.7	88.8	86.3	61.5	61.9	50.0	100.0
Total for both sexes	1		13		37		63		96		170		178		141		103		21		12	
	11.1		21.7		30.7		32.8		46.2		62.9		64.1		68.8		87.6		61.7		85.7	

TABLE NO. 84

Line (i)

Age	9		10		11		12		13		14		15		16		17		18		Ad.	
Sex (School)	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
P. Public					0				1													
					.0				100.0													
G. Public			1	1	0	1	9	10	8	5	12	5	4	4	13	6	3	2	3	1		
			14.3	25.0	.0	6.3	31.1	24.4	27.6	12.8	31.6	17.3	20.0	20.0	68.4	40.0	60.0	66.7	60.0	50.0		
Catholic	0	0	3	0	5	9	5	18	28	18	48	78	57	57	32	70	30	55	7	14	1	9
	.0	.0	7.7	.0	9.8	22.5	8.0	31.0	32.8	32.8	54.7	67.9	59.3	39.9	50.9	65.7	75.0	78.7	87.5	73.6	50.0	90.0
Total for all schools	0	0	4	1	5	10	14	28	37	23	60	83	61	61	45	76	33	57	10	15	1	9
	.0	.0	8.7	7.7	7.7	17.9	15.1	28.3	32.6	24.4	47.4	57.3	52.5	37.8	42.7	61.6	73.3	78.1	76.9	71.4	50.0	90.0
Total for both sexes	0		5		15		42		60		143		122		111		90		25		10	
	.0		8.5		12.5		21.8		28.8		52.9		43.9		54.2		76.5		73.5		83.3	

The value of this test lies in the fact that it displays the ability of the individual to analyze common acts into their constituent parts for purposes of comparison with other acts similarly analyzed. Inability to analyze the qualities under consideration precludes inability to compare them with other qualities essentially dissimilar. Intensified study of the answers received would, if it were undertaken, show to what extent the subject comprehended the terms involved, and recognized their common factors. This recognition gives evidence of an appreciation of their moral value. For our purposes it was considered sufficient that the subject give a real likeness or a real difference to be credited.

Group VIII. Vocabulary.

The vocabulary as it is to be used in the standardized form consists of forty-six words. These words were used in the reprinted blank given to the Catholic school children.[3] The Table below records the results on these words only, starting with age 9 and proceeding through adult age. The number of cases at adult age is so small, however, that it was decided not to use this age in constructing a standard for the different age groups. It was found necessary also in formulating this standard to consider the Public and Parochial schools separately, owing to the difference in the extent of the respective moral vocabularies. This difference which shows that the Catholic school children have the wider vocabulary is due undoubtedly to the constant training these children receive in the catechism where most of the words contained in our list appear. The difference is interesting from the pedagogical standpoint especially, because it shows what acceleration can be brought about by systematic training along the lines of vocabulary.

The absolute number and the percentage answering each word correctly is given in Table No. 85. Each age group is considered separately and is divided further into C (Catholic) and P (public).

[3] See p. 19 for method of compiling this vocabulary test.

The list of words used for this test are as follows:

1	*God*	13	*pity*	24	*pride*	35	*murder*
2	*bad*	14	*lust*	25	*mercy*	36	*counsel*
3	*sin*	15	*hope*	26	*death*	37	*patience*
4	*sad*	16	*soul*	27	*Satan*	38	*suicide*
5	*lie*	17	*charity*	28	*anger*	39	*blasphemy*
6	*hell*	18	*abhor*	29	*virtue*	40	*effeminate*
7	*love*	19	*gratitude*	30	*heaven*	41	*infanticide*
8	*flirt*	20	*snob*	31	*justice*	42	*veneration*
9	*obey*	21	*cruel*	32	*courage*	43	*patricide*
10	*kind*	22	*steal*	33	*worship*	44	*degradation*
11	*devil*	23	*gentle*	34	*obstinate*	45	*Sadism*
12	*holy*					46	*manslaughter*

A definition was considered correct if it gave a logical meaning for the word and if it also involved a moral concept. By a logical definition we understand one which gives a meaning of the word commonly accepted as correct. Occasionally a word may be given a logical definition and yet be marked minus in the record because it contains no moral concept. Our purpose is primarily not to get definitions for the words but rather to see at what age the moral concept becomes evident.

The number of words passed at the various ages for the two groups of children follow:

Age	9	10	11	12	13	14	15	16	17	18
Catholic	9	15	17	19	21	22	21	28	30	40
Public		8	11	9	15	12	12	22	13	20

The results have been used as they stand for purposes of standardization, yet it is felt that the lack of progressive growth in the public schools is due largely to the comparatively small number of cases considered. These cases number less than 75 at the 10, 11, 16, 17 and 18-year-age-groups, while at 12, 13, 14 and 15 they number between 75 and 100.

TABLE NO. 85—VOCABULARY

Age / School / Word	9 C	9 P	10 C	10 P	11 C	11 P	12 C	12 P	13 C	13 P	14 C	14 P	15 C	15 P	16 C	16 P	17 C	17 P	18 C	18 P	Ad. C	Ad. P
1. God	25		119	18	178	39	189	82	222	97	264	97	306	75	187	28	102	4	28	6	12	1
	75.8		78.5	85.7	78.0	89.8	83.5	86.1	93.2	87.3	90.3	88.3	95.2	92.3	96.3	90.4	96.9	80.0	100.0	100.0	100.0	100.0
2. Bad	25		140	19	216	42	209	72	219	93	275	75	310	60	173	23	100	3	27	4	11	1
	75.8		92.4	100.0	91.6	97.9	92.4	91.4	95.9	92.1	93.8	86.3	96.7	89.4	91.7	92.0	96.0	75.0	96.4	80.0	91.6	100.0
3. Sin	27		140	18	210	47	210	84	215	90	271	97	305	68	183	26	103	1	27	5	12	1
	81.0		91.0	90.0	96.6	95.9	92.8	70.7	93.7	77.4	92.7	89.2	94.9	87.0	97.0	96.2	99.0	25.0	96.4	100.0	100.0	100.0
4. Sad	22		126	15	216	35	198	69	206	91	272	75	296	57	174	23	96	3	24	5	11	
	66.7		84.4	83.4	91.2	85.4	87.5	88.3	91.1	91.0	93.3	86.3	92.6	86.0	92.6	100.0	92.2	100.0	92.3	100.0	91.6	
5. Lie	29		141	13	217	40	208	69	208	94	285	75	300	59	181	22	102	3	24	4	12	1
	87.9		94.5	72.3	95.9	93.2	91.9	89.7	91.9	94.0	98.3	86.3	96.0	89.7	95.9	100.0	97.9	100.0	96.0	100.0	100.0	100.0
6. Hell	25		119	13	180	33	186	72	188	92	260	91	294	64	184	24	103	3	26	4	12	
	75.8		78.5	68.4	79.6	77.5	82.6	77.8	83.1	77.3	90.0	83.7	92.0	81.9	97.0	85.7	99.0	100.0	100.0	100.0	100.0	
7. Love	26		121	4	189	32	175	51	200	13	237	44	273	21	166	20	99	2	26	2	11	
	78.8		81.1	20.0	83.5	65.3	77.7	58.7	88.4	12.1	83.0	40.9	87.1	27.9	88.0	71.4	95.0	66.7	100.0	50.0	91.6	
8. Flirt	12		72	2	100	20	98	28	112	12	179	25	198	19	133	10	85	1	20	3	10	
	36.4		47.5	11.1	44.4	47.6	43.3	37.0	67.2	12.2	62.4	29.3	63.4	29.3	71.2	41.7	81.6	33.3	77.0	75.0	83.3	
9. Obey	32		142	16	215	36	206	67	208	90	276	79	295	56	180	20	101	1	26	4	11	1
	97.0		95.1	90.0	91.6	83.9	91.9	88.4	91.9	91.8	96.0	92.4	94.4	94.6	93.7	83.4	98.0	33.3	100.0	100.0	91.6	100.0
10. Kind	30		134	14	207	37	196	64	200	75	262	68	268	54	167	20	90	3	24	1	11	
	90.9		89.8	77.8	91.9	97.4	88.2	85.1	88.4	76.5	92.0	79.6	86.8	83.2	88.8	87.0	89.1	100.0	92.3	50.0	91.6	
11. Devil	24		122	15	186	23	180	60	193	87	254	83	278	45	170	21	99	3	26	2	12	1
	72.7		80.5	78.9	83.0	50.0	81.0	66.6	86.9	79.2	89.2	73.0	90.4	68.4	89.6	77.7	99.0	100.0	100.0	100.0	100.0	100.0
12. Holy	23		131	12	187	35	186	62	193	85	249	81	266	53	175	22	96	3	25	2	11	
	66.7		86.5	63.1	84.2	77.8	83.9	68.8	86.9	72.3	87.9	68.9	87.3	72.6	91.0	81.4	96.0	100.0	96.2	100.0	91.6	
13. Pity	16		98	5	160	30	169	42	165	53	222	55	246	40	156	16	93	2	24	1	11	
	48.5		64.7	29.4	72.0	73.2	76.4	55.4	74.6	53.5	79.0	57.2	80.9	64.4	83.0	69.6	93.9	66.7	92.3	50.0	91.6	
14. Lust	1		10	0	7	0	14	15	19	6	36	7	45	12	83	13	42	2	17	1	7	
	3.1		6.6	.0	3.2	.0	6.4	20.0	8.6	6.2	12.9	7.4	14.9	19.3	44.4	56.6	42.4	66.7	65.5	50.0	58.3	
15. Hope	11		61	3	63	3	40	19	44	10	72	22	58	15	136	14	67	2	22	0	10	
	33.3		40.2	5.9	29.0	7.3	18.1	25.3	19.9	10.2	25.6	23.1	19.3	24.6	73.2	60.9	67.7	66.7	84.6	.0	83.3	
16. Soul	7		55	0	71	6	70	28	59	32	83	46	95	30	144	14	71	0	22	1	10	
	23.3		36.9	0	32.8	13.6	31.6	31.1	26.8	27.5	29.8	39.1	31.6	41.1	77.8	57.8	71.7	.0	84.6	50.0	83.3	
17. Charity	19		96	2	159	16	169	31	183	54	245	59	258	40	167	17	90	2	24	2	11	
	63.3		64.3	11.8	74.1	39.0	77.4	43.1	83.1	56.2	90.4	62.0	77.4	67.6	90.7	77.4	91.8	66.7	92.3	100.0	91.6	
18. Abhor	3		7	2	11	11	23	33	43	22	71	24	110	26	100	10	59	2	22	1	7	
	10.0		4.7	11.8	5.1	26.8	10.5	43.9	19.6	22.9	25.6	25.2	36.6	46.5	54.0	45.5	59.6	66.7	84.7	50.0	58.3	
19. Gratitude	4		40	4	100	11	99	33	145	30	194	27	215	29	160	13	87	3	24	1	10	
	12.9		43.2	23.5	46.6	26.8	45.3	43.9	66.7	31.2	70.4	31.9	71.6	50.8	86.4	59.2	87.9	100.0	92.4	50.0	83.3	
20. Snob	1		28	1	40	7	60	38	80	25	129	25	133	27	125	12	67	1	22	1	8	
	3.0		18.8	5.9	18.8	17.5	27.5	50.9	36.6	26.0	44.8	26.3	44.7	45.6	65.0	54.6	67.7	33.3	81.7	50.0	66.6	
21. Cruel	22		125	12	174	27	178	42	175	76	249	80	252	50	165	20	88	1	23	2	12	
	72.6		83.7	70.6	82.1	53.5	81.5	52.4	80.2	77.5	89.4	84.0	84.1	84.5	89.1	91.0	90.6	33.3	88.6	100.0	100.0	
22. Steal	22		133	16	198	34	201	67	200	94	268	86	285	54	182	19	92	2	25	1	12	
	72.6		89.1	94.1	93.5	67.5	92.5	61.9	91.6	96.8	96.5	90.3	95.8	91.3	96.5	90.5	94.8	66.7	96.3	50.0	100.0	
23. Gentle	21		116	11	163	33	167	56	172	68	241	75	232	44	158	18	85	2	23	2	11	
	69.3		77.7	64.7	77.9	80.5	77.2	57.8	78.8	77.5	86.8	78.8	78.0	74.4	85.3	85.7	86.7	66.7	88.6	100.0	91.6	
24. Pride	8		78	3	90	15	89	42	97	25	167	26	156	29	141	19	77	2	24	1	10	
	17.4		52.3	18.8	43.4	38.4	41.8	52.4	44.4	25.8	61.1	30.9	53.5	50.8	76.1	90.5	78.5	66.7	92.4	50.0	83.3	
25. Mercy	15		74	3	114	21	119	30	144	37	194	46	196	32	135	16	69	1	21	2	9	
	50.0		49.6	18.8	55.3	63.8	56.2	40.5	66.2	38.4	71.2	48.8	67.2	56.0	72.9	76.2	71.8	33.3	80.9	100.0	90.0	
26. Death	4		54	1	34	1	52	33	62	20	129	25	137	21	147	7	81	1	24	1	10	
	13.2		36.2	6.3	16.6	2.6	24.6	44.6	28.4	23.4	44.1	26.5	47.0	36.8	79.4	33.3	82.6	33.3	92.4	50.0	100.0	
27. Satan	14		70	7	111	14	143	41	179	58	234	53	248	34	166	16	86	2	24	2	10	
	46.2		46.9	43.8	54.2	36.8	68.1	55.4	82.3	60.3	85.9	56.2	82.6	59.5	89.6	76.2	88.6	66.7	92.4	100.0	100.0	
28. Anger	19		106	9	140	24	138	49	153	63	208	57	209	37	143	16	77	1	23	2	9	
	62.7		72.1	56.3	68.3	63.1	65.7	55.1	70.4	65.5	76.8	61.3	72.3	64.8	78.7	76.2	80.1	33.3	88.6	100.0	90.0	
29. Virtue	4		29	1	41	4	51	15	87	15	122	21	156	30	111	7	71	0	24	2	9	
	38.0		19.4	6.3	20.0	10.5	24.4	20.3	40.7	15.6	45.0	22.6	52.4	52.5	61.1	33.3	74.6	.0	92.4	100.0	90.0	
30. Heaven	20		116	8	167	52	164	79	183	87	238	87	260	52	170	23	91	2	26	1	10	
	69.0		78.9	44.5	81.8	72.3	79.0	62.6	85.6	74.8	88.8	74.0	90.7	75.4	93.5	92.0	95.6	66.7	100.0	50.0	100.0	
31. Justice	2		54	1	49	3	66	28	80	22	155	33	148	30	128	16	72	3	23	2	9	
	6.9		36.2	7.7	24.5	9.9	32.3	37.8	39.0	23.1	57.8	39.6	57.9	54.6	70.4	80.0	76.3	100.0	88.6	100.0	90.0	
32. Courage	8		60	3	93	8	104	35	144	34	171	39	195	22	141	16	77	3	24	1	10	
	27.6		40.2	23.1	47.4	26.4	50.1	47.3	70.0	35.4	64.0	51.5	68.6	40.7	77.6	80.0	81.6	100.0	92.4	50.0	100.0	
33. Worship	14		84	2	132	16	142	36	162	45	216	49	227	29	157	14	87	2	24	0	10	
	48.3		51.1	15.4	67.3	52.8	69.9	48.6	76.8	38.7	80.8	58.8	79.9	52.8	86.4	70.0	92.2	66.7	92.4	.0	100.0	
34. Obstinate	1		9	1	13	16	32	16	57	22	83	38	138	28	110	11	69	0	22	1	10	
	3.5		6.1	7.7	6.6	5.3	16.0	21.6	20.3	30.6	31.1	52.8	49.1	45.1	60.5	55.0	74.5	.0	84.7	50.0	100.0	
35. Murder	23		116	9	166	12	178	56	190	88	252	81	269	42	176	16	39	1	26	1	9	
	82.1		78.9	69.2	84.7	39.6	88.8	75.6	90.4	95.9	94.5	88.3	95.8	76.4	96.8	80.0	41.3	33.3	100.0	50.0	90.0	
36. Counsel	1		20	1	11	7	30	9	58	6	90	52	105	10	107	9	67	2	21	1	8	
	4.4		13.8	7.0	5.7	23.1	15.3	12.2	27.9	6.5	34.2	56.7	37.5	18.2	59.9	45.0	72.4	66.7	80.9	50.0	80.0	
37. Patience	3		31	1	40	10	43	19	45	11	77	14	92	22	118	15	63	2	22	1	8	
	13.1		21.4	7.7	20.8	33.3	21.9	26.1	21.8	12.0	29.3	15.3	32.8	40.0	66.1	75.0	68.0	66.7	84.7	50.0	80.0	
38. Suicide	7		45	4	94	7	115	38	156	70	222	68	246	35	170	12	89	3	25	2	10	
	35.0		32.0	30.8	47.9	23.1	58.7	52.1	76.1	76.3	85.0	74.1	87.8	63.7	89.5	60.0	96.1	100.0	96.3	100.0	100.0	
39. Blasphemy	4		16	0	50	1	77	37	112	9	163	13	185	18	136	13	87	0	24	1	10	
	20.0		11.5	.0	26.0	3.3	40.0	53.7	55.1	9.8	62.1	14.2	67.2	34.0	76.2	65.0	86.1	.0	92.4	50.0	100.0	
40. Effeminate	0		1	1	1	0	7	37	11	26	21	4	44	27	55	9	34	1	11	1	5	
	.0		0.7	7.7	0.5	.0	3.7	53.7	5.4	28.1	8.3	4.4	16.0	50.0	31.4	45.0	39.8	33.3	44.0	50.0	55.6	
41. Infanticide	0		0	1	0	0	0	1	1	8	3	5	5	6	14	10	4	1	2	0	5	
	.0		.0	7.7	.0	.0	.0	1.5	0.5	8.5	0.1	5.5	1.8	11.1	7.8	50.0	4.8	33.3	8.0	.0	55.6	
42. Veneration	0		0	0	0	0	8	3	22	3	45	5	97	4	81	2	50	0	22	0	6	
	.0		.0	.0	.0	.0	4.2	4.3	10.8	3.2	17.8	5.5	37.2	7.4	45.4	10.0	60.0	.0	88.0	.0	60.0	
43. Patricide	0		0	0	0	0	2	2	1	13	12	9	14	6	28	2	29	1	13	1	4	
	.0		.0	.0	.0	.0	1.1	2.9	0.5	13.8	4.7	9.8	5.1	11.1	15.7	10.0	34.5	33.3	52.0	50.0	44.4	
44. Degradation	0		0	0	0	0	1	2	7	7	9	11	24	8	73	5	40	0	15	1	4	
	.0		.0	.0	.0	.0	0.5	2.9	3.3	8.3	35.6	12.0	8.7	14.8	41.6	25.0	48.0	.0	60.0	50.0	50.0	
45. Sadism	0		0	0	0	0	0	0	0	0	2	2	1	1	3	0	5	0	1	0	0	
	.0		.0	.0	.0	.0	.0	.0	.0	.0	0.8	2.2	0.4	1.8	1.7	.0	6.0	.0	4.0	.0	.0	
46. Manslaughter	4		35	1	49	32	94	30	119	41	155	47	176	37	122	7	55	3	20	2	5	
	21.0		25.9	7.7	26.0	52.5	49.8	43.5	58.5	48.8	62.0	52.2	64.1	68.5	69.5	35.0	93.0	100.0	83.3	100.0	71.3	

CHAPTER VII

The Moral Problems of Childhood

Four items of our questionnaire have enabled us to get a particularly good insight into the moral development of the child. They are: *Name three things it is good to do, Name three things it is wrong to do, What one action do you consider the best a person can do during life* and *What one action do you consider the worst a person can do during life.* They bring out in strong relief the relative value of various faults and virtues in the mind of the child as these show themselves in the process of his development. The things mentioned by the children were classified under the general heading of "Duty." Considered in this way, the good actions mentioned are in accordance with one's duty, and the wrong actions are violations of the same. Duty was subdivided into the groups "To God," "To social groups," "To the family," "To superiors and friends," "To any human being," "To maintain personal integrity," "To animals,"[1] "Combination of obligations" and "False concepts." As is shown in the Tables which follow, each of these groups is further divided into quite concrete and definite classes of right or wrong actions.

The same general form has been used for all the Tables giving results on these questions. The classification of right or of wrong actions explained above, is given in the first column of each Table. There is a separate column for each age group, the age being given at the top. Each column has also been divided giving results separately for boys (B) and girls (G). The upper figure in each space represents the number of cases mentioning that particular act as right or wrong. The lower figure (in heavy print) represents the percentage this number is of the total number taking the test. Immediately below the line giving the ages, is a

[1] Strictly speaking, man has no duties to animals. This division was made to take care of acts which were mentioned by the subjects, and could not be classified elsewhere.

series of figures which represents the total number of cases at each age to whom the question was presented. To the right of the last age column, is a column with the heading, "Age of 10%." In this, there is given for each action named and separately for boys and girls, the first age at which more than 10 percent of the subjects name this act. The last column in each Table which has the heading, "Age of Max." (maximum) gives the age at which the maximum percentage is reached for each good or bad act.

The results to be considered are from five groups of schools in which tests were given. Each of these groups is from a different city and therefore that a comparison of environmental differences would be possible, results for each school have been tabulated separately. It is to be regretted that the number of cases presented at the upper and lower ages, particularly 17, 18 and "Ad.," and 6, 7 and 8 are not larger. While the number of cases from 9 through 16 may be considered large enough to give fairly representative results, those above and below these limits are too few to be considered anything but suggestive.

Tables No. 86 and No. 87 below, give the number of answers and percentages for each good action mentioned in the Catholic Individual and Group test, at all ages tested. Tables No. 88 and No. 89 present for the same school groups the number of answers and percentages for the action considered the *"best a person can do during life."* Tables No. 90 through 93 present the results compiled from the answers to this question in the P. Public and G. Public schools, respectively.

An attempt was made to classify the answers of the children. The moral acts mentioned by the children were designated by a number of captions and these brief designations appear in the Tables. That an idea may be given of the various moral acts included under each caption, the following list has been prepared. It consists of the captions found in the tables, followed by a number of samples from the children's papers that will give the reader a fairly comprehensive idea of what each caption includes.

Religious acts: to pray, to go to church, to attend Mass, to

TABLE NO. 86

Table No. 86 presents the results from the Catholic Individual tests which were given in answer to the question, *Name three things it is good to do.*

C. I.

	Age	6		7		8		9		10		Age of 10%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	No. of Cases	8	4	18	19	9	19	5	2	13	1				
To God	Religious Acts	8 100.0	2 50.0	20 111.2	13 68.4	14 155.4	9 47.3	2 20.0	4 200.0	20 15.4	0	6	6	8	(9)
	Personal Piety					1 11.1	0					8		8	
	Worship			3 16.9	2 10.5	1 11.1	4 21.0			1 7.7	0	7	7	7	8
	Follow Vocation														
To Social Group	Country														
	Church														
	School	1 12.5	0	3 16.9	2 10.5	0	5 26.3			1 7.7	0	6	7	7	8
	Clubs and Gangs														
To Family	Respect Authority	6 75.0	3 75.0	7 38.9	13 68.4	3 33.3	21 110.5	4 40.0	1 50.0	10 76.9	1 100.0	6	6	10	8
	Render Assistance					0	2 10.5	1 20.0	0	3 23.1	0	9	8	10	8
To Friends and Superiors	Courtesy														
	Gratitude														
To any Human Being	Charity			2 11.1	0	0	1 5.3	3 60.0	0	1 7.7	0	7		9	8
	Politeness														
	Negative Virtue	1 12.5	0	3 16.9	2 10.5	5 55.6	1 5.3	3 60.0	0	5 38.5	0	6	7	9	7
	Optimism														
	To be Gentle	1 12.5	0	3 16.9	2 10.5	1 11.1	6 31.6	2 40.0	0			6	7	9	8
To Maintain Personal Integrity	Purity									1 7.7	0			10	
	Preserve Health														
	Honorable														
	To be Honest	2 25.0	0	1 5.6	1 5.3					2 15.4	1 100.0	6	(10)		(10) 7
	Mortification														
	Unselfishness			0	3 15.8								7		7
	Industry														
	Courage														
To Animals	Humaneness														
Combination of Obligations	Be Good	4 50.0	1 25.0	3 16.9	4 21.0	0	3 15.6	0	1 50.0			6	6	6	(9) 6
	Physical Exercise														
	Recreation			0	3 15.8	1 11.1	1 5.3					8	7	8	7
	Trade in Life														
False Concepts	Unconventional			1 5.6	0									7	

C. I. W.

	Age	6		7		8		9		10		11		Age of 10%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	No. of Cases	3	6	5	13	6	6	3	3	6	6	2	7				
To God	Religious Acts	1 33.3	2 33.3	4 80.0	13 100.0	3 50.0	3 50.0			3 50.0	1 16.7	1 50.0	3 42.8	6	6	7	7
	Personal Piety					1 16.7	0		1 33.3					8		8	
	Worship	0	3 50.0	0	1 7.7	1 16.7	0	0	1 33.3					8	6	8	6
	Follow Vocation																
To Social Group	Country																
	Church																
	School	1 33.3	0					0	1 33.3					(6)	(9)	(6)	(9)
	Clubs and Gangs																
To Family	Respect Authority	2 66.7	3 50.0	5 100.0	6 46.1	5 83.3	3 50.0	2 66.7	1 33.3	4 66.7	7 115.8	1 50.0	0	6	6	7	10
	Render Assistance																
To Friends and Superiors	Courtesy																
	Gratitude																
To any Human Being	Charity	0	3 50.0	1 20.0	2 15.4	3 50.0	3 50.0			5 83.3	5 83.3			7	6	10	10
	Politeness									0	1 16.7				10		10
	Negative Virtue	0	1 16.7			3 50.0	0	2 66.7	0					8	6	9	6
	Optimism																
	To be Gentle									0	1 16.7	1 50.0	0	11	10	11	10
To Maintain Personal Integrity	Purity	0															
	Preserve Health																
	Honorable			0	1 7.7	1 16.7	0	0	1 33.3					8	(9)	8	(9)
	To be Honest			0	1 7.7	1 16.7	0			0	1 16.7			8	10	8	10
	Mortification																
	Unselfishness																
	Industry																
	Courage																
To Animals	Humaneness																
Combination of Obligations	Be Good	0	2 33.3	2 40.0	5 38.5	3 50.0	4 66.7	1 33.3	2 66.7	2 33.3	1 16.7	2 100.0	0	7	6	(11) 8	8
	Physical Exercise																
	Recreation	0	1 16.7												6		6
	Trade in Life																
False Concepts	Unconventional																

TABLE NO. 87

Table No. 87 presents the results from the Catholic school group tests which were given in answer to the question, *Name three things it is good to do.*

	Age	9		10		11		12		13		14		15		16		17		18		Ad.		Age of 90%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	No. of Cases	18	7	75	64	88	127	106	113	134	81	150	150	145	182	78	124	43	70	9	26	2	19				
Duty: To God	Religious Acts	2 11.1		65 86.5	33 51.5	71 80.9	102 80.5	96 90.2	79 69.5	128 96.0	72 88.6	120 80.4	142 90.1	140 96.6	123 56.7	76 97.8	68 55.1	28 65.2	27 38.6	7 77.8	14 53.9	1 50.0	7 36.8	9	10	16	14
	Personal Piety	1 5.6		4 5.3	2 3.1	7 8.0	12 9.4	9 8.5		1 0.8	5 6.2	14 9.4	6 4.0		1 0.6	3 3.9	5 4.1	3 7.0	2 2.9	1 11.1		1 50.0	1 5.3	18		(Ad.) 14	11
	Worship			14 18.6	8 12.5	2 2.3	2 1.5	1 0.9	11 9.7	11 8.3	13 16.0	3 2.0	4 3.0	7 4.8	7 3.9		3 2.4	2 4.7	9 12.9	1 11.1	3 10.6		2 10.5	10	10	10	13
	Follow Vocation					1 1.1			1 0.9	1 0.8																11	12
To Social Groups	Country							1 0.9		3 2.3				1 0.7												13	
	Church							1 0.9																		12	
	School	1 5.6		4 5.3	3 4.7	5 5.7	8 6.3	1 0.9	8 7.0	6 4.5	4 4.9	7 4.7	8 5.4	9 6.2	6 3.3	4 5.1	7 5.7		2 2.9							15	12
	Clubs and Gangs																										
To Family	Respect Authority	4 22.4	3 32.9	25 33.3	31 48.4	35 39.9	60 47.4	35 32.9	63 55.4	55 41.3	36 44.3	62 41.5	74 49.6	72 49.7	94 51.7	23 29.4	65 52.7	12 28.0	20 28.6	4 44.4	10 38.5	2 100.0	3 15.8	9	9	(Ad.) 15	12
	Render Assistance			4 5.3		5 5.7	3 2.4	1 0.9	21 28.5	5 3.8	1 1.2	4 2.7	2 1.3	3 2.1	14 7.7	1 1.3	4 3.2		3 4.3	3 33.3	3 10.6		1 5.3	18	12	18	12
To Friends and Superiors	Courtesy							4 3.8	1 0.9	1 0.8		1 0.7							2 2.9							12	17
	Gratitude												1 0.7				1 0.8				1 3.9						18
To any Human Being	Charity	7 38.9	1 14.3	8 10.6	13 20.3	22 25.1	105 83.0	21 19.7	40 35.2	61 45.8	48 59.0	86 57.3	108 72.4	57 39.3	129 41.0	62 79.4	88 71.3	34 79.2	40 57.2	7 77.8	12 46.2		13 68.4	9	9	16	11
	Politeness			2 2.7	2 3.1	2 2.3	1 0.8	1 0.9	4 3.5	3 2.3	1 1.2	2 1.3	4 2.7			5 6.4		1 2.3								16	12
	Negative Virtue	3 16.7	1 14.3	10 13.3	3 4.7	8 9.1	2 1.5	10 9.4	2 1.8	4 3.0		4 2.7	3 2.0			1 1.3								9	9	9	9
	Optimism				3 4.7	1 1.1	1 0.8	3 2.8		1 0.8	1 1.2	4 2.7	4 3.0	5 3.5	6 3.3			1 2.3			2 7.7					15	18
	To be Gentle	5 27.8		23 29.6	19 29.6	37 42.2	4 3.2	26 24.4	26 22.9	27 20.3	1 1.2	27 17.1	38 25.5	25 17.3	60 33.0	14 17.9	38 30.8	3 7.0	19 27.2	2 22.2	8 30.8	2 100.0	5 26.3	9	10	(Ad.) 11	15
Duty: To Maintain Personal Integrity	Purity				1 1.6	1 1.1	2 1.5		3 2.6	2 1.5	2 2.5	1 0.7		2 1.4	2 1.1			1 2.3	1 1.4							17	12
	Preserve Health					2 2.3			1 0.9					1 0.7	1 0.6			1 2.3								11	12
	Honorable	1 5.6		5 6.7	9 14.0	6 6.8	15 11.9		4 3.5	14 10.5	2 2.5	9 5.8	20 13.4	13 9.0	4 2.2	10 12.8	31 25.1	3 7.0	3 4.3				1 5.3	13	10	16	16
	To be Honest			3 4.0	2 3.1		6 4.7	10 9.4	14 12.3		10 12.3	13 8.7	11 7.5		35 19.3	1 1.3	7 5.7	6 14.0	5 7.2		6 23.1			17	12	17	18
	Mortification	1 5.6						1 0.9	1 0.9	2 1.5	1 1.2	2 1.3		1 0.7	5 2.8	1 1.3	2 1.6	2 4.7					1 5.3			9	Ad.
	Unselfishness	1 5.6		1 1.3	1 1.6		2 1.5	2 1.9	3 2.6	8 6.0	2 2.5			6 4.1		3 3.8	7 5.7	2 4.7	1 1.4							13	16
	Industry						1 0.8									2 2.6	3 2.4	2 4.7								17	16
	Courage			1 1.3																						10	
To Animals	Humaneness																										
Combination of Obligations	Be Good	1 5.6		8 10.6	8 12.5	14 16.0	19 15.0	14 13.2	23 20.2	1 0.8	10 12.3		21 14.1		24 13.2	3 3.8	9 8.2		4 5.7	3 33.3	1 3.9		1 5.3	10	10	18	12
	Physical Exercise							2 1.9							1 0.6											12	15
	Recreation					1 1.1	3 2.4	1 0.9	2 1.8					1 0.7	1 0.6											11	11

TABLE NO. 88

Table No. 88 presents the results from the Catholic Individual tests which were given in answer to the question, *What one action do you consider the best a person can do during life.*

C. I.

	Age	6		7		8		9		10		Age of 10%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	No. of Cases	8	4	17	19	9	19	4	2	13	1				
Duty: To God	Religious Acts			7 41.2	9 47.3	8 88.8	10 52.6	1 25.0	1 50.0	7 53.8	0	7	7	8	8
	Personal Piety	1 12.5		0 .0	1 5.3	1 11.1	1 5.3	2 50.0	0	1 7.7	0	6		9	7
	Worship	2 25.0	1 25.0	3 17.6	3 15.8					1 7.7	0	6	6	6	6
	Follow Vocation														
Duty: To Social Groups	Country														
	Church														
	School									1 7.7				10	
	Clubs and Gangs														
Duty: To Family	Respect Authority	1 12.5	1 25.0			0	1 5.3			1 7.7	1 100.0	6	6	6	10
	Render Assistance														
Duty: To Friends and Superiors	Courtesy														
	Gratitude														
Duty: To any Human Being	Charity	0	1 25.0					1 25.0	0			9	6	9	6
	Politeness														
	Negative Virtue			1 5.9	0										
	Optimism														
	To be Gentle			2 11.8	0			0	1 50.0			7	9	7	9
To Maintain Personal Integrity	Purity									1 7.7					
	Preserve Health														
	Honorable														
	To be Honest														
	Mortification			1 5.9										7	
	Unselfishness														
	Industry														
	Courage														
To Animals	Humaneness														
Combination of Obligations	Be Good	1 12.5	0	2 11.8	2 10.5	0	6 31.6					6	7	6	8
	Physical Exercise														
	Recreation														
	Trade in Life														
False Concepts	Unconventional														

C. I. W.

	Age	6		7		8		9		10		11		Age of 10%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	No. of Cases	3	6	5	11	6	6	3	3	6	6	2	1				
Duty: To God	Religious Acts	2 66.7	0	3 60.0	5 45.5	0	3 50.0	2 66.7	0	2 33.3	3 50.0	0	1 100.0	6	7	9	(11) 8-10
	Personal Piety	0	1 16.7					0	1 33.3						6		(9) 6
	Worship	0	1 16.7	0	2 18.2	2 33.3	0							8	6	8	7
	Follow Vocation																
Duty: To Social Groups	Country																
	Church																
	School																
	Clubs and Gangs																
Duty: To Family	Respect Authority			1 20.0	1 9.1	1 16.7	0					1 50.0	0	7		7	(11) 7
	Render Assistance																
Duty: To Friends and Superiors	Courtesy																
	Gratitude																
Duty: To any Human Being	Charity					2 33.3	3 50.0			1 16.7	0			8	8	8	8
	Politeness																
	Negative Virtue																
	Optimism																
	To be Gentle																
To Maintain Personal Integrity	Purity																
	Preserve Health																
	Honorable																
	To be Honest																
	Mortification									0	1 16.7				10		10
	Unselfishness																
	Industry																
	Courage																
To Animals	Humaneness																
Combination of Obligations	Be Good			0	1 9.1					1 16.7	2 33.3	1 50.0	0	10	10	11	10
	Physical Exercise	1 32.3	1 16.7											6	6	6	6
	Recreation																
	Trade in Life																
False Concepts	Unconventional	0	1 16.7												6		6

TABLE NO. 89

Table No. 89 presents the results from the Catholic Schools group test which were given in answer to the question, *What one action do you consider the best a person can do during life.*

	Age	9		10		11		12		13		14		15		16		17		18		Ad.		Age of 10%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	No. of Cases	18	6	71	60	87	126	102	109	120	81	148	149	143	182	76	125	43	70	9	26		12				
Duty: To God	Religious Acts	6 33.4	5 83.3	25 35.8	21 35.1	22 25.3	35 27.7	24 23.5	24 22.1	30 23.4	16 19.7	29 20.4	15 10.1	21 14.7	29 16.0	9 11.9	6 4.8	3 7.0	5 7.2	1 11.1		0		9	9	10	9
	Personal Piety	3 16.7	0	6 8.6	1 1.7	1 1.2	20 15.8	20 19.6	4 3.7	25 19.5	9 11.1	5 3.4	31 20.8	18 12.6	44 24.2	19 35.1	20 16.0	9 21.0	17 24.3	4 44.4	4 15.4	0	2 16.7	9	11	18	17
	Worship	1 5.6	0	8 11.4	7 11.7	9 10.4	9 7.1	1 1.0	11 10.1	27 21.1	9 11.1	22 15.0	14 9.4	22 15.4	4 2.2	11 14.5	11 8.8	5 11.7	9 12.9	1 11.1			4 33.3	10	10	13	Ad.
	Follow Vocation			3 4.3	1 1.7	9 10.4	2 1.6	10 9.8	4 3.7	13 10.1	5 6.2	19 12.9	7 4.7	21 14.7	17 9.4	13 17.2	26 20.8	2 4.7	6 8.6		1 3.9			11	16	16	16
Duty: To Social Group	Country										6 7.4							3 7.0								17	13
	Church																										
	School																										
	Clubs and Gangs																										
Duty: To Family	Respect Authority			1 1.4	1 1.7		5 4.0	5 4.9	10 9.2	6 4.7		15 10.2	9 6.0	1 0.7	5 2.8	6 7.9	5 4.0	1 2.3		1 11.1				14		18	12
	Render Assistance																										
Duty: To Friends and Superiors	Courtesy			1 1.4						1 0.8											2 7.7					10	18
	Gratitude																			1 11.1				18		18	
Duty: To any Human Being	Charity			5 7.2	3 5.0	11 12.7	12 9.5	7 6.9	16 14.7	11 8.6		15 10.2	25 16.8	14 8.9	53 29.2	9 11.9	21 16.8	7 16.3	18 .25.7		5 19.3		3 25.0	11	12	17	15
	Politeness						1 0.8	1 1.0	1 0.9				1 0.7		1 0.6											12	12
	Negative Virtue	1 5.6		1 1.4																						9	
	Optimism									1 0.8																13	
	To be Gentle	0	1 16.7	6 8.6	1 1.7	6 6.9	13 10.3	6 5.9	11 10.1	4 3.1	7 8.6	8 5.4	12 8.0			3 4.0	7 5.6		6 8.6	1 11.1	4 15.4			18	9	18	9
Duty: To Maintain Personal Integrity	Purity				3 2.0			1 1.0	9 8.3	5 3.9	8 9.8	14 9.5	1 0.7		2 1.1						2 7.7					14	14
	Preserve Health													1 0.7												15	
	Honorable					1 1.2			2 1.8		1 1.2	2 1.4	7 4.7		5 2.8				1 1.4							14	14
	To be Honest	1 5.6	0		2 3.3		4 3.2	2 2.0	1 0.9			3 2.0			4 2.2		1 0.8									9	10
	Mortification												3 2.0		3 3.3		3 2.4		2 2.9				1 8.3				Ad.
	Unselfishness				1 1.7						11 13.5		1 0.7												13		13
	Industry															1 1.3		1 2.3								17	
	Courage																										
Duty: To Animals	Humaneness																										
Duty: Combination of Obligations	Be Good					10 11.5								9 6.3			10 8.0	3 16.3						11		17	16
	Physical Exercise			1 1.4																						10	
	Recreation																										
	Trade in Life																										
False Concepts	Unconventional																										

TABLE NO. 90

Table No. 90 presents the results from the P. Public School group tests which were given in answer to the question, *Name three things it is good to do.*

Duty	Age	10		11		12		13		14		15		16		Age of 10%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	No. of Cases	13	14	27	20	31	28	34	27	21	13	9	2	3	2				
To God	Religious Acts	3 23.1	5 35.7	12 44.4	9 45.0	14 45.2	4 14.3	10 29.4	9 33.3	9 42.8	4 30.8	1 11.1	1 50.0	3 100.0	0	10	10	(16) 12	(15) 11
	Personal Piety	1 7.7		1 3.7		2 6.5		3 8.8	1 3.7									13	13
	Worship	1 7.7	2 14.3	2 7.4		4 12.9	4 14.3	5 14.7	5 1.9	0	1 7.7					12	10	13	10
	Follow Vocation							1 2.9										13	
To Social Groups	Country			1 3.7		2 6.5			1 3.7	1 4.8	0							12	13
	Church																		
	School			1 3.7	1 5.0	1 3.2	1 3.6	2 5.0	2 7.4	4.8	0							13	13
To Family	Respect Authority	5 38.5	8 57.1	11 40.7	14 70.0	16 51.7	21 78.5	19 55.9	21 77.7	8 38.1	9 69.2	3 33.3	2 100.0	1 33.3	2 100.0	10	10	13	(15) 12
	Render Assistance	1 7.7				1 3.2		2 5.0		1 4.8	0							10	
To Friends and Superiors	Courtesy						1 3.6			0	0								12
	Gratitude				1 5.0			1 2.9										13	11
To any Human Being	Charity	5 38.5	4 23.0	23 85.1	15 75.0	18 58.1	22 75.0	12 35.3	10 37.0	8 38.1	13 100.0	5 55.5	0	0	2 100.0	10	10	11	14
	Politeness								3 11.1	1 4.8	0						13	14	13
	Negative Virtue	9 69.2	5 35.7		2 10.0	4 12.9				5 23.8	3 23.1			1 33.3	0	10	10	10	10
	Optimism									2 9.5	0							14	
	To be Gentle	4 30.8	4 28.6	10 37.0	6 30.0	15 48.5	13 50.0		14 51.8	6 28.6	6 46.1	0	1 50.0	3 100.0	1 50.0	10	10	(16) 12	13
To Maintain Personal Integrity	Purity	3 23.1							1 3.7							10		10	13
	Preserve Health																		
	Honorable	4 30.8	5 35.7	6 27.2	5 30.0	5 16.2	4 14.3	5 14.9	3 11.1	4 19.0	8 61.5	6 66.6	1 50.0	0	1 50.0	10	10	15	14
	To be Honest	2 15.3	1 7.1	3 11.1	2 10.0	7 22.6	3 10.7	6 17.6	6 22.2			5 55.5	1 50.0			10	11	15	(15) 13
	Unselfishness									1 4.8	0							14	
	Industry																		
	Courage																		
To Animals	Humaneness																		
Combination of Obligations	Be Good	1 7.7	1 7.1	2 7.4	7 35.0			10 29.4		2 9.5	0	4 44.4	0			15	11		
	Physical Exercise																		
	Recreation									1 4.8	1 7.7							14	14

TABLE NO. 91

Table No. 91 presents the results from the G. Public School group tests which were given in answer to the question, *Name three things it is good to do.*

Duty	Age / Sex	10 B	10 G	11 B	11 G	12 B	12 G	13 B	13 G	14 B	14 G	15 B	15 G	16 B	16 G	17 B	17 G	18 B	18 G	Ad. B	Ad. G	Age of 10% B	Age of 10% G	Age of Max. B	Age of Max. G
	No. of Cases	8	12	19	23	38	45	49	59	55	56	42	37	23	14	7	4	10	3	5	3				
To God	Religious Acts	4 50.8	10 83.3	5 26.3	5 21.8	34 89.4	21 46.6	43 87.7	34 57.5	58 105.5	28 50.0	20 47.6	20 54.0	16 69.6	4 28.6	2 28.6	1 25.0	1 10.0	2 66.7	2 40.0	0	10	10	14	10
	Personal Piety			0	1 4.4	4 10.5	3 6.7	3 6.1	1 1.7	1 1.8	4 7.2	2 4.8	6 16.2			1 14.3	0			1 20.0	0	12	15	17	15
	Worship			3 15.8	4 17.4	3 7.9	6 13.3	3 6.1	4 6.8	0	4 7.2	2 4.8	5 13.5			1 14.3	0	3 35.0	0	1 20.0	0	11	11	18	11
	Follow Vocation			1 5.3	0			1 2.0	0	3 5.5	5 9.0													14	14
To Social Groups	Country	..						1 2.0	1 1.7			1 2.4	0					2 20.0	0			18		18	13
	Church											0	1 2 7												15
	School			1 5.3	2 8.7			3 6.1	1 1.7	2 3.6	2 3.6			2 8.7	0									16	11
	Clubs and Gangs																								
To Friends and Superiors — To Family	Respect Authority	1 12.5	5 41.7	9 47.3	8 26.1	21 55.2	25 55.5	27 55.1	28 64.3	24 44.7	24 43.0	11 26.2	11 29.7	8 34.8	5 35.7	2 28.6	2 50.0	1 10.0	1 33.3	1 20.0	0	10	10	12	13
	Render Assistance			1 5.3	1 4.4	1 2.6	0	0	1 1.7	1 1.8	1 1.8	5 11.9	0	4 17.4	1 7.1	1 14.3	0	1 10.0	0			15		16	16
To Friends and Superiors	Courtesy									1 1.8	2 3.6	1 2.4	1 2.7					1 10.0	0	1 20.0	0	18		Ad.	14
	Gratitude																								
To any Human Being	Charity	1 12.5	7 58.3	9 47.3	12 52.2	10 26.3	43 95.5	20 40.8	27 45.6	23 41.9	28 49.3	15 35.7	24 64.8	4 17.4	2 14.3	1 14.3	1 25.0	5 50.0	3 100.0	1 20.0	2 66.7	10	10	18	(18) 12
	Politeness	1 12.5	1 8.3	0	2 8.7					1 1.8	0	0	2 5.4			2 28.6	1 25.0					10	17	17	17
	Negative Virtue	0	1 8.3					4 8.2	0	2 3.6	3 5.4	4 9.5	1 2.7	3 13.1	0					3 60.0	0	16		Ad.	14
	Optimism	2 25.0	3 25.0	0	1 4.4	1 2.6	0	0	1 1.7							1 14.3	0					10	10	10	10
	To be Gentle	1 12.5	2 16.7	6 31.6	11 47.9			19 49 0	17 28.7	20 36.4	16 28.6	11 26.2	14 37.8	5 21.8	3 21.4	4 57.2	1 25.0	2 20.0	3 100.0	2 40.0	3 33.3	10	10	17	(18) 11
To Maintain Personal Integrity	Purity									1 1.8	0	2 4.8	0	2 8.7	1 7.1	1 14.3	0					17		17	
	Preserve Health					5 13.2	0					6 14.3	1 2.7	2 8.7	0			1 10.0	0			12		15	15
	Honorable	2 25.0	4 33.3	4 21.0	6 26.1	6 15.8	5 11.1	6 12.2	11 18.6	7 12.7	7 12.5	4 9.5	4 10.8	4 17.4	3 21.4	1 14.3	0					10	10	10	10
	To be Honest			2 10.5	3 13.1	5 13.2	3 6.7	5 10.2	2 3.4	9 16.4	5 9.0	4 9.5	5 13.5			2 28.6	0	2 20.0	0	2 40.0	1 33.3	11	11	Ad.	(Ad.) 15
	Mortification																								
	Unselfishness			1 5.3	0			0	3 5.1	0	1 1.8	1 2.4	3 8.1	10 43.5	6 42.8	1 14.3	0	1 10.0	0			16	16	16	16
	Industry			0	1 4.4			0	1 1.7	1 1.8	0													14	11
	Courage																								
To Animals	Humaneness			1 5.3	0																			11	
Combination of Obligations	Be Good	2 25.0	5 41.7	1 5.3	1 4.4	1 2.6	3 6.7	8 14.3	4 6.8	11 20.0	9 16.1	1 2.4	0	3 13.1	1 7.1							10	10	10	10
	Physical Exercise											4 9.5	1 2.7											15	15
	Recreation					1 2.6	0	8 14.3	1 1.7			5 11.9	2 5.4	5 21.8	0							13		16	15

TABLE NO. 92

Table No. 92 presents the results from the P. Public Schools *best a person can do during life.*
What one action do you consider the group tests which were given in answer to the question,

Duty	Age / Sex	10 B	10 G	11 B	11 G	12 B	12 G	13 B	13 G	14 B	14 G	15 B	15 G	16 B	16 G	Age of 10% B	Age of 10% G	Age of Max. B	Age of Max. G
	No. of Cases	13	14	21	20	31	28	34	26	21	13	9	2	3	2				
To God	Religious Acts			3 14.3	1 5.0		1 3.6	1 2.9	2 7.7	2 9.5	1 7.7			1 33.3		11		11	13
	Personal Piety	1 7.7		2 9.5	1 5.0	4 12.9	2 7.1	2 5.9	1 3.9	1 4.8	1 7.7					12		12	14
	Worship	1 7.7	2 14.2	2 9.5	2 10.0	3 9.7	1 3.6	4 11.8	2 7.7	0	4 30.8	1 11.1				13	10	13	14
	Follow Vocation				1 5.0	2 6.5		1 2.9										12	11
To Social Groups	Country																		
	Church																		
	School									0	1 7.7								14
To Family	Render Assistance							2 5.9	1 3.9	2 9.5	0							14	13
	Respect Authority			2 9.5	3 15.0	3 9.7	2 7.1	1 2.9		0	2 15.3						11	12	14
To Friends	Courtesy	2 15.3			3 15.0											10	11	10	11
	Gratitude																		
To any Human Being	Charity	3 23.1	2 14.2	6 28.6	2 10.0	6 19.4	2 28.6	5 14.7	5 19.3	2 9.5	1 7.7	1 11.1			2 100.0	10	10	11	12
	Politeness																		
	Negative Virtue																		
	Optimism								2 7.7										13
	To be Gentle	1 7.7	4 28.6	3 14.3	4 20.0	5 16.2	4 14.3	8 23.5	3 11.6	0	2 15.3	2 22 2	1 50.0	1 33.3		11	10	(16) 13	(15) 10
To Maintain Personal Integrity	Purity					1 3.2								1 33.3		(16)		(16) 12	
	Preserve Health			1 4.8														11	
	Honorable		2 14.2	3 14.3	2 10.0		1 3.6		1 3.9	1 4.8	1 7.7					11	10	11	10
	To be Honest					2 6.5			1 3.9	0	1 7.7	1 11.1				15		15	14
	Mortification							2 5.9										13	
	Unselfishness				1 5.0					1 4.8	0								11
	Industry	1 7.7							1 3.9									10	13
	Courage					1 3.2													
To Animals	Humaneness																		
Combination of Obligations	Be Good			3 14.3		1 3.2	4 14.3	3 8.8	3 11.6	2 9.5	0	2 22.2				11	12	15	12
	Physical Exercise																		
	Recreation						1 3.6												12

TABLE NO. 93

Table No. 93 presents the results from the G. Public Schools which were given in answer to the question, *What one action do you consider the best a person can do during life.*

Duty	Age	10		11		12		13		14		15		16		17		18		Ad.		Age of 10%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	No. of Cases	8	12	19	23	38	43	49	58	48	64	42	37	23	13	6	3	3	10	4	3				
To God	Religious Acts	3 37.5	1 8.3	0	1 4.4	5 13.2	4 9.3	4 8.2	7 12.0	2 4.2	0											10	13	10	13
	Personal Piety	1 12.5	0	7 36.8	4 17.4	1 2.6	2 4.7	5 10.2	6 10.3	2 4.2	3 4.7	4 9.5	1 2.7	4 17.4	3 23.1							10	11	11	16
	Worship	4 50.0	1 8.3	3 15.8	0	7 18.4	3 7.0	10 20.4	9 15.5	12 25.0	9 14.0	12 28.6	11 29.7	5 21.8	1 7.7			1 33.3	0			10	13	10	15
	Follow Vocation					0	1 2.3	0	1 1.7	2 4.2	0	3 7.1	0			1 16.7	0					17		17	12
To Social Groups	Country									1 2.1	0					2 33.4	0			1 25.0	0	17		17	
	Church																								
	School									0	1 1.6			1 4.4	0									16	
	Clubs and Gangs																								
To Family	Respect Authority					0	3 7.0	5 10.2	2 3.4	3 6.2	1 1.6	0	2 5.4	1 4.4	0							13		13	12
	Render Assistance			0	1 4.4			1 2.0	1 1.7	3 6.2	1 1.6	2 4.8	0	3 13.1	0	2 33.3	0			25.0		16		13	12
To Friends and Superiors	Courtesy																								
	Gratitude																								
To any Human Being	Charity	1 12.5	2 16.7	11 57.9	5 21.8	9 23.7	10 23.3	7 14.3	12 18.9	16 33.3	12 18.7	11 26.2	7 18.9	8 26.1	4 30.8	1 16.7	0	1 33.3	1 10.0	2 50.0	2 66.7	10	10	11	(Ad.) 16
	Politeness																								
	Negative Virtue							1 2.0	0															13	
	Optimism																	1 33.3	0			(18)		(18)	
	To be Gentle					2 5.3	4 9.3	6 12.2	3 5.2	0	4 6.2							1 33.3	0	1 25.0	0	13		(18) 13	12
To Maintain Personal Integrity	Purity									8 16.6	5 7.8			3 13.1	1 7.7			2 66.7	1 10.0			14	18	(18) 14	18
	Preserve Health																								
	Honorable					3 7.9	2 4.7			2 4.2	0	1 2.4	0											12	12
	To be Honest			2 10.5	2 8.7	3 7.9	3 7.0	1 2.0	0	2 4.2	2 3.1	1 2.4	1 2.7									11		11	11
	Mortification													2 8.7	0									16	
	Unselfishness							2 4.1	1 1.7															13	13
	Industry																								
To Animals	Courage																								
	Humaneness																								
Combination of Obligations	Be Good					2 5.3	1 2.3	1 2.0	4 6.9							0	2 66.7						(17)	12	(17) 13
	Physical Exercise																								
	Recreation											1 2.4	0											15	
	Trade in Life									1 2.1	0	2 4.8	1 2.7											15	15

go to Sunday School, to receive the Sacraments (go to Confession, to Holy Communion), to say "Grace."

Personal piety: to be holy, to renounce temptation, to reform, to read the Bible, to avoid sin, to convert souls, to love holy things, to be pious, to give good example, to be devout, to go with good companions.

Worship: to adore God, to love God, to serve God.

To follow one's vocation: to be a Religious, to be a Priest, to be a Sister, to get married.

Duties to church: to help support the church.

Duties to school: to obey the regulations, to know your lessons, to behave in school.

Duty to respect authority: (in the family) obedience to parents, specific act of obedience (not to smoke, to go to school, etc.).

Duty to render assistance (at home): to help your mother, go to the store, to work, to give your mother your money, etc.

Courtesy: reverence.

Charity: to love, to be charitable, to help others, almsgiving, pity, works of mercy, to be merciful, to forgive.

Optimism: to hope, to be cheerful, to be happy.

Negative virtue: not to steal, not to swear, not to kill, not to fight, etc. (These acts are too indefinite to be considered outside of the tables.)

To be gentle: to be kind, to be thoughtful, to be patient, to be humble, to be docile.

Purity: to be pure, to be modest, to have clean thoughts, to have clean amusements.

To be honorable: to be truthful, to have honor, to be true, to be reliable.

Honesty: sincerity, to be honest.

Mortification: penance, self-sacrifice, to fast.

Industry: to be industrious, to be ambitious.

Tables No. 94 through No. 97 present for the tests from the Catholic schools and Individual tests, respectively, the number and percentage of children naming certain actions in answer to the questions: *Name three things it is wrong to do,* and *What one action do you consider the worst a person can do during life?*

Tables No. 98 through No. 101 present corresponding results on these same questions for the P. Public and G. Public schools respectively.

The terms used in these tables are generalizations of the terms used in the papers of the subjects and include the following:

Blasphemy: to swear, to curse, to take the Lord's name in vain, to blaspheme, sins against the Second Commandment.

Unbelief: to lack faith, not to believe in God, idolatry, atheism.

Violation of religious duties: to miss Mass, to omit prayers, not to love God, to work on Sundays.

Contrary to authority (in the family): disobedience, specific acts of disobedience (smoking, playing truant, etc.), to be bad, to be stubborn, to run away.

Discourtesy: to talk back, to be rude, to be saucy, to be snippy, to strike a priest, to strike a teacher.

Against charity: to be angry, to be unkind, to tattle, to scandalize others, to gossip, to talk of others, to be jealous, to wish evil, to be mean, to hurt others, to hate.

Against purity: to look at bad pictures, to tell bad jokes or stories, to read bad books.

Impurity: to think bad, to be immodest, to be immoral, to think or do evil.

Sloth: to be lazy, not to work.

Unconventional acts: to flirt, to go with bad companions, to be vulgar, to go riding with fellows.

Deceptiveness: to gamble, to be false, not to play fair.

Pride: to be vain, to be haughty, to be proud.

TABLE NO. 94

Table No. 94 presents the results from the Catholic Individual tests which were given in answer to the question, *Name three things it is bad to do.*

C. I.

Duty	Age / Sex	6 B	6 G	7 B	7 G	8 B	8 G	9 B	9 G	10 B	10 G	Age of 10% B	Age of 10% G	Age of Max. B	Age of Max. G
	No. of Cases	8	4	17	20	9	19	5	2	13	1				
To God	Blasphemy	4 50.0	0	7 41.2	6 30.0	5 55.5	5 26.3	4 80.0	1 50.0	13 100.0	0	6	7	10	(9)
	Unbelief														
	Violation of Rel. Duties	7 87.5	3 75.0	21 123.6	10 50.0	8 88.9	7 36.8	0	1 50.0	4 30.8	1 100.0	6	6	7	(10) 6
	Sin			0	1 5.0	0	1 5.3								8
To Social Groups	Country					1 11.1	0					8		8	
	Church														
	School			1 5.9	0									7	
	Clubs and Gangs														
To Family	Contrary to Authority	14 50.0	2 50.0	11 64.7	13 65.0	5 55.6	19 100.0	3 60.0	1 50.0	5 38.5	0	6	6	7	8
	Divorce														
	Adultery														
To Superiors and Friends	Discourtesy			0	1 5.0	0	1 5.3			1 7.7	0			10	8
To Human Beings	Vs. Charity	2 25.0	1 25.0	1 5.9	0	1 11.1	0	1 20.0	0	2 15.4	0	6	6	6	6
	Vs. Purity					0	1 5.3			1 7.7	0			10	8
	Vs. Honesty														
	Stealing	6 75.0	0	1 5.9	7 35.0	1 11.1	9 49.3	2 40.0	1 50.0	4 30.8	0	6	7	6	(9) 8
	Lying	1 12.5	0	2 11.8	7 35.0	3 33.3	5 26.3	2 40.0	1 50.0	5 38.5	1 100.0	6	7	9	(10) 7
	Murder							1 20.0	0	1 7.7	0	9		9	
	Fighting			1 5.9	0	2 22.2	1 5.3	2 40.0	0	5 38.5	1 100.0	8	(10)	9	(10)
	Impurity														
To Maintain Personal Integrity	Sloth														
	Vs. Conventions														
	Deceptiveness					0	1 5.3								8
	Selfishness			0	1 5.0	0	2 10.5						8		8
	Pride			1 5.9	0									7	
	Cheating					0	1 5.3								8
To Animals	Cruelty														
Combination of Obligations	Intemperance					0	1 5.3								8
False Concepts	Religious			2 11.8	0	1 11.1	0					7		7	
	Non-religious	0	2 50.0	0	1 5.0								(6)		

C. I. W.

Duty	Age / Sex	6 B	6 G	7 B	7 G	8 B	8 G	9 B	9 G	10 B	10 G	11 B	11 G	Age of 10% B	Age of 10% G	Age of Max. B	Age of Max. G
	No. of Cases	3	6	5	13	6	6	3	3	6	6	2	1				
To God	Blasphemy			3 60.0	2 15.4	1 16.7	1 16.7	1 33.3	0	2 33.3	0	1 50.0	1 100.0	7	7	7	(11) 8
	Unbelief			0	1 7.7												7
	Violation of Rel. Duties	2 36.7	4 66.7	3 60.0	8 61.5	0	5 20.0	0	2 66.7	1 16.7	2 33.3	1 50.0	0	(6) 7	6	7	6
	Sin					0	2 33.3			1 16.7	1 16.7			10	8	10	8
To Social Groups	Country																
	Church																
	School	1 33.3	1 16.7	0	2 15.4			0	1 33.3					(6)	6	6	9
	Clubs and Gangs																
To Family	Contrary to Authority	1 33.3	3 50.0	3 60.0	8 61.5	7 118.3	4 67.6	2 66.7	1 33.3	3 50.0	4 67.6			(6) 7	6	8	8
	Divorce																
	Adultery																
To Superiors and Friends	Discourtesy	0	1 16.7												6		6
To Human Beings	Vs. Charity	0	1 16.7	0	1 7.7			0	1 33.3						6		9
	Vs. Purity																
	Vs. Honesty																
	Stealing	0	3 50.0	1 20.0	4 30.8	4 67.6	1 16.7			2 33.3	4 67.6	1 50.0	1 100.0	7	6	8	(11) 10
	Lying	1 33.3	3 50.0	2 40.0	4 30.8	3 50.0	1 16.7	1 33.3	1 33.3			0	1 100.0	(6) 7	6	8	(11) 6
	Murder					1 16.7	0					1 50.0	0	8		(11) 8	
	Fighting	1 33.3	0	2 40.0	0	2 33.3	0	2 66.7	0	3 50.0	3 50.0	1 50.0	0	(6) 8	10	9	10
	Impurity																
To Maintain Personal Integrity	Sloth																
	Vs. Conventions																
	Deceptiveness																
	Selfishness					0	2 33.3			1 16.7	2 33.3			10	8	10	8
	Pride																
	Cheating	0	1 16.7														
To Animals	Cruelty					1 16.7	1 16.7							10	8	10	8
Combination of Obligations	Intemperance																
False Concepts	Religious																
	Non-religious	0	1 16.7												6		6

TABLE NO. 95

Table No. 95 presents the results from the Catholic School group tests which were given in answer to the question, *Name three things it is bad to do.*

Duty	Age / Sex	9 B	9 G	10 B	10 G	11 B	11 G	12 B	12 G	13 B	13 G	14 B	14 G	15 B	15 G	16 B	16 G	17 B	17 G	18 B	18 G	Ad. B	Ad. G	Age of 10% B	Age of 10% G	Age of Max. B	Age of Max. G
	No. of Cases	18	7	77	66	89	132	106	115	139	81	148	150	145	182	78	125	43	70	9	26	2	11				
To God	Blasphemy	9 50.0	2 28.6	38 49.4	19 28.9	43 48.1	34 25.8	60 56.4	51 44.4	78 56.2	32 39.4	80 54.4	57 38.2	84 58.0	58 31.9	48 61.4	36 28.8	28 65.2	11 15.7	6 66.6	6 23.1	0	4 36.4	9	9	18	12
	Unbelief					1 1.1						0	2 1.3	2 1.4	1 0.6	1 1.3	1 0.8	0	0	1 11.1	0	0	1 9.1	18		18	Ad.
	Violation of Rel. Duties	3 16.7	1 14.3	16 20.8	12 18.1	25 28.0	32 25.1	12 11.3	18 15.7	19 13.7	6 6.4	17 11.6	16 10.7	17 11.7	20 11.0	7 9.0	17 13.6	8 18.6	2 2.9	1 11.7	2 7.7	0	2 18.2	9	9	11	11
	Sin	3 16.7	0	10 13.0	9 13.6	10 11.2	19 14.4	11 10.3	15 13.1	14 10.1	6 6.4	1 0.7	9 6.0	2 1.4	0	3 3.8	3 2.4	9	2 2.9	1 11.1	3 11.6			9	10	9	11
To Social Groups	Country			1 1.3						1 0.7	0			3 2.1	0						5 19.3				18	15	18
	Church																										
	School			2 2.6	3 4.6	1 1.1	2 1.5			4 2.9	0	0	1 0.7	0	5 2.8	0	1 0.8									13	10
	Clubs and Gangs																										
To Family	Contrary to Authority	5 27.8	4 57.2	17 22.1	18 27.4	22 24.6	50 38.0	21 19.7	43 37.4	31 22.4	30 36.9	43 29.2	46 30.8	24 16.6	70 38.5	11 14.1	40 32.0	7 16.3	19 27.2			0	7 63.6	9	9	14	Ad.
	Divorce					0	1 0.8																				11
	Adultery											0	1 0.7	1 0.7		2 2.6	0	2 4.7	0			1 50.0	0	(Ad.)		(Ad.) 17	14
To Superiors, Friends	Discourtesy	1 5.6				2 2.2	4 2.9	1 .94	1 0.9	1 0.7	0	0	3 2.0	0	3 1.7	2 2.6	1 0.8									9	11
To Human Beings	Vs. Charity	2 11.1	0	6 7.8	2 3.0	2 2.2	5 3.8	4 3.8	11 3.9	8 5.8	4 3.9	6 4.1	10 6.7	6 4.1	10 5.5	5 6.4	26 20.8	4 9.3	7 10.0	1 11.1	4 15.4	0	2 18.2	9	16	9	16
	Vs. Purity	1 5.6	0	3 3.9	1 1.5	4 4.5	11 8.4			2 1.4	2 2.5		2 1.3			1 1.3	3 2.4	2 4.7	2 2.9	0	1 3.9					9	11
	Vs. Honesty	0	1 14.3											0	2 1.1		1 0.8								9		9
	Stealing	9 50.0	3 42.9	42 54.6	26 39.5	50 56.0	74 56.2	73 68.6	72 62.6	81 58.3	49 60.3	103 70.0	99 66.3	94 64.9	138 75.9	45 57.6	88 70.4	29 67.6	43 61.5	8 88.8	14 53.9	1 50.0	10 90.9	9	9	18	Ad.
	Lying	6 33.4	1 14.3	33 42.9	23 35.0	27 30.2	56 42.6	42 39.5	50 42.5	56 40.4	41 50.4	55 37.4	74 39.6	42 20.0	100 55.0	23 29.4	71 56.8	9 21.0	35 50.1	2 22.2	13 50.1	0	7 63.6	9	9	10	Ad.
	Murder	4 22.2	2 28.6	33 42.9	17 25.8	29 32.5	53 40.3	37 34.8	37 32.2	52 37.5	37 44.5	61 41.0	58 49.6	57 39.3	69 38.0	28 35.8	42 33.6	14 32.6	23 32.9	4 44.4	4 15.4	2 100.0	4 36.4	9	9	Ad. 18	14
	Fighting	2 11.1	1 14.3	11 14.3	9 13.6	5 5.6	12 9.1	13 12.2	8 7.0	22 15.9	7 7.6	16 10.9	10 6.7	15 10.3	23 12.7	10 12.8	10 8.0	3 7.0	2 2.9	0	1 3.9			9	9	13	9
To Maintain Personal Integrity	Impurity					2 2.2	5 3.8	1 0.9	3 2.6	4 2.9	1 1.2	12 8.2	1 0.7	10 6.9	10 5.5	6 7.7	1 0.8									14	15
	Sloth					2 2.2	2 1.5	1 0.9	1 0.9	0	1 1.2	0	2 1.3	2 1.4	1 0.6	0	1 0.8	0	1 1.4							11	11
	Vs. Conventions	1 5.6	1 14.2	2 2.6	1 1.5	3 3.4	6 4.6	3 2.8	11 9.6	4 2.9	2 2.5	3 2.0	1 0.7	0	6 3.6	0	2 1.6	1 2.3	3 4.3						9	9	9
	Deceptiveness			0	1 1.5					3 2.2	0	4 2.7	1 0.7	9 6.2	1 3.3	5 6.4	4 3.2	1 2.3	3 4.3							16	17
	Selfishness			1 1.3	5 7.6	4 4.5	1 0.8	1 0.9			1 1.2			3 2.1	8 4.4			1 2.3	2 2.9							11	10
	Pride			0	1 1.5					1 0.8	0	0	1 0.7	0	3 1.7											13	15
	Cheating	5 27.8	2 28.6	11 14.3	5 7.6	5 5.6	16 12.2	17 16.0	15 13.1	18 13.0	10 12.3	20 13.6	29 19.4	31 21.4	23 12.7	23 29.4	0	5 11.7	4 5.7	2 22.2	3 11.6	1 50.0	0	9	9	(Ad.) 16	9
To Animals	Cruelty			1 1.3	0	1 1.1	2 1.5	0	1 0.9			0	1 0.7													10	11
	Intemperance	0	1 14.3	.0		0	1 0.8			1 0.8			2 1.3	3 2.1	4 2.2	3 3.8	0	1 2.3	1 1.4	1 11.1				18	9	18	9
Combination of Obligations																											
False Concepts	Religious															1 1.3	0									16	
	Non-religious					1 1.1	0							1 0.7	0											11	

TABLE NO. 96

Table No. 96 presents the results from the Catholic Individual tests which were given in answer to the question, *What one action do you consider the worst a person can do during life.*

C. I.

	Age / Sex	6 B	6 G	7 B	7 G	8 B	8 G	9 B	9 G	10 B	10 G	Age of 10% B	Age of 10% G	Age of Max. B	Age of Max. G
	No. of Cases	8	4	17	19	9	19	4	2	13	1				
To God	Blasphemy	1 12.5	1 25.0	3 17.6	5 26.3	4 44.4	3 15.8	2 50.0		6 47.1	1 100.0	6	6	10	10
	Unbelieving	1 12.5	1 25.0		4 21.0		1 5.3					6	6	6	6
	Violation of Rel. Duties					3 33.3	1 5.3		1 50.0			8	9	8	9
	Sin	2 25.0	1 25.0	4 23.5	2 10.5		2 10.5					6	6	6	6
To Social Groups	Country			2 11.8								7		7	
	Church														
	School									1 7.7				10	
	Clubs and Gangs														
To Family	Contrary to Authority	1 12.5		3 17.6		1 11.1	4 21.0					6	8	7	8
	Divorce														
	Adultery														
To Superiors, Friends	Discourtesy														
To Human Beings	Vs. Charity			1 5.9	1 5.3		2 10.5	1 25.0				9	8	9	8
	Vs. Purity														
	Vs. Honesty														
	Stealing	2 25.0		2 11.8	4 21.0		1 5.3			1 7.7		6	7	6	7
	Lying				1 5.3	1 11.1	1 5.3					8		8	7
	Murder			1 5.9	1 5.3		2 10.5	1 25.0		4 30.8		9	8	10	8
	Fighting				1 5.3		1 5.3								7
To Maintain Personal Integrity	Impurity														
	Sloth														
	Unconventional														
	Deceptiveness														
	Selfishness								1 50.0						9
	Pride														
	Cheat														
To Animals	Cruelty														
Combination of Obligations	Intemperance														
False Concepts	Religious			1 5.9											
	Non-religious														

C. I. W.

	Age / Sex	6 B	6 G	7 B	7 G	8 B	8 G	9 B	9 G	10 B	10 G	11 B	11 G	Age of 10% B	Age of 10% G	Age of Max. B	Age of Max. G
	No. of Cases	3	6	5	11	6	6	3	3	6	6	2	1				
To God	Blasphemy	2 66.7	1 16.7	1 20.0	3 27.3	0	3 50.0	0	1 33.3	0	2 33.3			6	6	6	8
	Unbelieving	0	2 33.3	1 20.0	0									7	6	7	6
	Violation of Rel. Duties			2 40.0	0			1 33.3	0					7		7	
	Sin	0	1 16.7							0	2 33.3				6		10
To Social Groups	Country																
	Church																
	School																
	Clubs and Gangs																
To Family	Contrary to Authority	0	1 16.7	0	4 36.4	1 16.7	0								6		7
	Divorce																
	Adultery																
To Superiors, Friends	Discourtesy																
To Human Beings	Vs. Charity					1 16.7	0									8	
	Vs. Purity																
	Vs. Honesty																
	Stealing			0	1 9.1	0	2 33.3			1 16.7	1 16.7	1 50.0	0	10	8	11	8
	Lying			0	2 18.2										7		7
	Murder	1 33.3	1 16.7	1 20.0	0	4 66.7	0	1 33.3	0	2 33.3	0	1 50.0		[illegible]	6	8	6
	Fighting																
To Maintain Personal Integrity	Impurity																
	Sloth																
	Unconventional																
	Deceptiveness																
	Selfishness																
	Pride																
	Cheat																
To Animals	Cruelty									1 33.3	1 16.7			10	10	10	10
Combination of Obligations	Intemperance					0	1 16.7								8		8
False Concepts	Religious		1 16.7														6
	Non-religious																

TABLE NO. 97

Table No. 97 presents the results from the Catholic School, group tests which were given in answer to the question, *What one action do you consider the worst a person can do during life.*

Duty	Age	9		10		11		12		13		14		15		16		17		18		Ad.		Age of 10%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	No. of Cases	18	6	71	60	87	116	102	104	130	79	148	149	143	182	76	124	43	70	9	26	2	12				
To God	Blasphemy			3 4.3	2 3.3	6 6.9	8 6.9	4 3.9	3 2.9	10 7.7	1 1.3	6 4.1	1 0.7	5 3.5		3 4.0	3 2.4	3 7.0				0	1 8.3			13	Ad.
	Unbelieving	1 5.6		2 2.9	1 1.7	1 1.2	6 5.2	7 6.9	2 1.9	7 5.4	5 6.4	10 6.8	9 6.0	11 7.7	7 3.9	15 19.8	6 4.9	1 2.3	4 5.7	3 33.3	2 7.7	0	3 25.0	16	Ad.	18	Ad.
	Violation of Rel. Duties	1 5.6		8 11.4	8 13.4	8 9.2	10 8.6	3 2.9	9 8.6	8 6.2	5 6.4	13 8.8	6 4.0	3 2.1	6 3.3	3 4.0	1 0.8		1 1.4					10	10	10	10
	Sin			7 10.0	7 11.7	7 8.1		10 10.2	3 2.9	18 12.9	7 8.9	10 6.8	5 3.4	7 4.9	12 6.6	7 11.9	17 13.8	1 2.3	4 5.7	1 11.1	2 7.7	0	1 8.3	10	10	13	16
To Social Groups	Neglect											1 0.7			2 1.1		2 1.6									14	16
	Vocation																										
	Country									1 0.8		1 0.7						2 4.7								17	
	Church																										
	School																										
	Clubs and Gangs																										
To Family	Contrary to Authority						3 2.9	1 1.0	6 5.8	4 3.1	3 3.8	7 4.8	11 7.4	8 5.6	1 0.6	1 1.3	2 1.6	4 9.3	4 5.7							17	14
	Divorce																										
	Adultery										1 1.3				2 1.1			1 2.3								17	
To Friends, Superiors	Discourtesy	0	1 16.7		1 1.7	1 1.2			1 1.0							1 1.3		2 4.7							9	17	9
To Human Beings	Vs. Charity			1 1.4	1 1.7	1 1.2	2 1.7	1 1.0	3 2.9	3 2.3	1 1.3	6 4.1	3 2.0		14 7.7	4 5.3	9 7.3	2 4.7	1 1.4							16	15
	Vs. Purity																										
	Vs. Honesty						1 0.9								2 1.1		2 1.6				2 7.7						18
	Stealing			5 7.2	4 6.9	3 3.5	11 9.5	6 5.9	9 8.6	4 3.1	4 5.1	5 3.4	8 5.4	6 4.2	6 3.3	4 5.3	3 2.4		2 2.9							10	11
	Lying				2 3.3	1 1.2	1 0.9		3 2.9				1 0.7	1 0.7	5 2.8				2 2.9							11	10
	Murder	8 38.9	5 83.3	33 47.2	16 26.7	37 42.6	50 43.0	50 49.0	49 47.0	68 52.4	40 50.8	61 41.5	84 56.3	70 49.0	107 58.9	36 47.5	68 55.1	13 30.3	45 64.4	5 55.6	9 34.7	2 100.0	5 50.0	9	9	(Ad.) 18	19
	Fighting			1 1.4																							
To Maintain Personal Integrity	Impurity	1 5.6			1 1.8	1 1.2	1 0.9	2 2.0	1 1.0			10 6.8		4 2.8	1 0.6	1 1.3		2 4.7	1 1.4		2 7.7					14	18
	Sloth			1 1.4				1 1.0																			
	Unconventional			1 1.4				1 1.0					1 0.7	1 0.7	1 0.6				1 1.4							10	17
	Deceptiveness									1 0.8			2 1.3	1 0.7			1 0.8	1 2.3	1 1.4		1 3.9					17	18
	Selfishness					2 2.3	2 1.7	1 1.0		8 6.2	4 5.1		1 0.7	2 1.4			1 0.8	1 2.3								13	13
	Pride																2 1.6						1 8.3				Ad.
							3 2.6			1 0.8		2 1.4														14	11
To Animals	Cruelty													1 0.7				1 2.3								17	
Combination of Obligations	Intemperance						2 1.7	1 1.0							2 1.1				1 1.4							12	11
	Neglect Health													1 0.7												15	
False Concepts	Religious														1 0.6												15
	Non-Religious						1 0.9		1 1.0																		12

TABLE NO. 98

Table No. 98 presents the results from the P. Public School group tests which were given in answer to the question, *Name three things it is bad to do.*

		Age	10		11		12		13		14		15		16		Age of 10%		Age of Max.	
		Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G				
		No. of Cases	13	14	27	20	31	28	34	27	21	13	9	2	3	2				
Duty	To God	Blasphemy	8 61.5	9 64.3	15 55.5	15 75.0	13 42.0	12 42.8	21 61.7	12 44.4	14 66.6	7 53.8	1 11.1	1 50.0	3 100.0		10	10	(16) 14	11
		Unbelief		1 7.1				2 7.1		2 7.4										13
		Violation of Rel. Duties	1 7.7	6 42.8		1 5.0	1 3.2		2 5.9	2 7.4	2 9.5	2 15.4						10	14	10
		Sin	1 7.7	1 7.1	1 3.7	4 20.0	2 6.5	2 7.1		3 11.1	2 9.5		1 11.1				15	11	15	11
	To Social Groups	Country																		
		Church																		
		School																		
		Clubs and Gangs																		
	To Family	Contrary to Authority	2 15.4	5 35.7	8 29.6	6 30.0	9 29.1	14 50.0	10 29.4	8 29.6	3 14.3	6 46.1	1 11.1	1 50.0		1 50.0	10	10	11	(15) 12
		Divorce																		
		Adultery																		
	To Superiors, Friends	Discourtesy				2 10.0				1 3.7								11		11
	To Human Beings	Vs. Charity	2 15.4	5 35.7	2 7.4	3 15.0	2 6.5	6 21.4	2 5.9	3 11.1			2 22.2				10	10	15	10
		Vs. Purity																		
		Vs. Honesty								1 3.7										13
		Stealing	8 61.5	5 35.7	17 62.9	9 45.0	24 77.5	19 67.8	17 50.0	14 51.8	8 85.7	7 92.3	5 88.8	1 100.0	2 66.7	2 100.0	10	10	15	14
		Lying	4 30.8	6 42.8	10 37.0	10 50.0	19 61.4	11 39.3	15 44.1	13 48.1	8 38.1	7 53.8	5 55.5	1 50.0	2 66.7	2 100.0	10	10	(16) 12	(16) 14
		Murder	5 38.5	1 7.1	6 22.0	4 20.0	9 29.1	5 17.9	9 26.5	6 22.2	4 19.0	3 23.1	3 33.3				10	11	10	14
		Fighting	4 30.8		4 14.8	5 25.0	5 16.2	1 3.6	2 5.9	2 7.4	1 4.8						10	11	10	11
	To Maintain Personal Integrity	Impurity						2 7.1	2 5.9	1 3.7									13	12
		Sloth																		
		Vs. Conventions	1 7.7		1 3.7	1 5.0		1 3.6	3 8.8	5 18.5		1 7.7			1 33.3				(16) 13	13
		Deceptiveness			1 3.7						1 4.8								14	
		Selfishness									1 4.8								14	
		Pride			1 3.7															
		Cheating	3 23.1	5 35.7	10 37.0	11 55.0	11 35.5	5 17.9	6 17.6	5 18.5	2 9.5	4 30.3	3 33.3	1 50.0		1 50.0	10	10	11	(15) 11
	To Animals	Cruelty				2 10.0												11		11
	Combination of Obligations	Intemperance			3 11.1	1 5.0	1 3.2		1 2.9		1 4.8						11		11	11
	False Concepts	Religious																		
		Non-religious		1 7.1		1 5.0														10

TABLE NO. 99

Table No. 99 presents the results from the G. Public Schools group tests which were given in answer to the question, *Name three things it is bad to do.*

Duty	Age	10		11		12		13		14		15		16		17		18		Ad.		Age of 10%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
	No. of Cases	8	12	19	23	38	45	49	59	55	56	42	37	23	14	7	4	10	2	6	3				
To God	Blasphemy	4 50.0	5 41.7	8 42.1	10 43.5	29 76.3	23 51.1	41 83.6	24 40.6	43 78.3	34 60.9	24 57.1	16 43.2	17 74.0	7 50.0	5 71.5	2 50.0	1 10.0	1 50.0	4 66.7	0	10	10	13	14
	Unbelief			5 26.3				2 4.1	1 1.7	1 1.8	1 1.8	2 4.8	2 5.4	1 4.4				1 10.0				11		(18) 11	15
	Violation of Rel. Duties	2 25.0	1 8.3	2 10.5		1 2.6	2 4.4	6 12.2	1 1.7	4 7.3	2 3.6	2.7	1 8.7	2					1 50.0			10		10	15
	Sin				1 4.4	1 2.6	2 4.4	4 8.2	5 8.5	2 3.6	5 9.0	1 2.4	1 2.7	1 4.4				1 10.0			1 33.3			18	Ad. 14
To Social Groups	Country																								
	Church																								
	School																								
	Clubs and Gangs																								
To Family	Contrary to Authority	2 25.0	5 41.7	5 26.3	5 21.8	9 23.7	13 28.9	22 44.9	17 28.7	13 23.6	13 23.3	11 26.2	7 18.9	6 26.1	3 21.4	0	1 25.0			1 16.7	1 33.3	10	10	13	10
	Divorce																								
	Adultery							1 2.0		1 1.8		3 7.1						1 10.0				(18)		(18) 13	
To Superiors, Friends	Discourtesy		3 25.0		1 4.4			1 2.0	3 5.1				1 2.7				1 25.0						10	13	10
To Human Beings	Vs. Charity		2 16.7		3 13.1		5 11.1			2 3.6	3 5.4	1 2.4	6 16.2		2 14.3	2 28.6						17	10	17	10
	Vs. Purity									1 1.8	1 1.8													14	14
	Vs. Honesty						1 2.2						1 2.7												15
	Stealing	4 50.0	7 58.3	8 42.1	12 52.2	29 76.3	33 73.3	43 87.7	47 79.4	39 71.0	34 60.9	25 59.5	24 64.8	13 56.6	9 64.3	4 57.2	2 50.0	6 60.0	1 50.0	4 66.7	2 66.7	10	10	13	13
	Lying	1 12.5	5 41.7	9 47.3	12 52.2	21 55.2	27 59.9	15 30.6	23 39.9	25 45.5	25 44.8	13 30.9	18 48.6	6 26.1	3 21.4	2 28.9	2 50.0	6 60.0	1 50.0	3 50.0	1 33.3	10	10	18	12
	Murder	3 37.5	2 16.7	5 26.3	6 26.1	21 55.2	13 28.9	17 34.7	15 25.4	13 23.6	14 25.1	11 26.1	12 32.4	6 26.1	4 28.6	1 14.3	1 25.0	3 30.0	0	2 33.3	0	10	10	12	15
	Fighting		2 16.7	1 5.3			.2	4 8.2	7 11.8	6 10.9	3 5.4	3 7.1	2 5.4	3 13.1								14	10	16	10
To Maintain Personal Integrity	Impurity												2 5.4	1 4.4										16	15
	Sloth									1 1.8		1 2.4	0											15	
	Vs. Conventions						3 6.7	1 2.0	3 5.1	1 1.8	1 1.8	3 7.1	2 5.4	3 13.1								16		16	12
	Deceptiveness	1 12.5				1 2.6	2 4.4	1 2.0	2 3.4	4 7.3	4 7.2	3 7.1	1 2.7	4 17.4		2 28.6		2 20.0			1 33.3	10		17	(Ad.) 14
	Selfishness			1 5.3		1 2.6		1 2.0	1 1.7	2 3.6		1 2.4		1 4.4	2 14.3								16	11	16
	Pride										1 1.8														
	Cheating	1 12.5	6 50.0	4 21.0	5 21.8	8 21.0	10 22.2	14 28.6	13 22.0	6 10.9	13 23.3	8 19.0	9 24.3	7 30.5	3 21.4	2 28.6			2 10.0	2 33.3		10	10	16	10
To Animals	Cruelty					1 2.6	1 2.2		1 1.7			1 2.4												12	12
Combination of Obligations	Intemperance			2 10.5	1 4.4			4 8.2	2 3.4	4 7.3	2 3.6	6 14.3	2 5.4			3 42.9		1 10.0		3 50.0	1 33.3	11		Ad.	Ad. 15

TABLE NO. 100

Table No. 100 presents the results from the P. Public School group tests, which were given in answer to the question, *What one action do you consider the worst a person can do during life.*

		Age 10 B	10 G	11 B	11 G	12 B	12 G	13 B	13 G	14 B	14 G	15 B	15 G	16 B	16 G	Age of 10% B	Age of 10% G	Age of Max. B	Age of Max. G
	No. of Cases	13	14	22	20	31	28	34	27	21	13	9	2	3	2				
Duty: To God	Blasphemy	2 15.4	2 14.3	1 4.6	2 10.0	1 3.2	2 7.1	3 8.8	1 3.6	3 14.3	1 7.7	1 11.1	1 50.0			10	10	10	(15) 10
	Unbelieving		1 7.1	4 18.2	2 10.0	4 12.9	1 3.6	3 8.8	3 10.7		1 7.7					11	11	11	13
	Violation of Rel. Duties					1 3.2		1 2.9		1 4.8								14	
	Sin			1 4.6				1 2.9		1 4.8								14	
To Social Groups	Country									1 4.8	1 7.7							14	14
	Church																		
	School																		
	Clubs and Gangs																		
To Family	Contrary to Authority		2 14.3	5 22.8	2 10.0	1 3.2	1 3.6		2 7.1	1 4.8	2 15.3	1 11.1				11	10	11	14
	Divorce																		
	Adultery	1 7.7							1 3.6									10	13
To Superiors, Friends	Discourtesy						1 3.6												12
To Any Human Being	Vs. Charity	1 7.7		1 4.6	1 5.0	1 3.2	1 3.6	1 2.9	2 7.1	1 4.8	1 7.7				2 100.0			10	(16) 14
	Vs. Purity																		
	Vs. Honesty																		
	Stealing	5 38.5	2 14.3	2 9.1		4 12.9	5 17.9	3 8.8	12 42.8	4 19.0	3 23.1					10	10	10	13
	Lying		3 21.4		3 15.0	4 12.9	2 7.1	10 29.4				1 11.1	1			12	10	13	10
	Murder	2 15.4	2 14.3	9 41.0	10 50.0	8 25.8	9 32.1		6 21.4	4 19.0	4 30.8	1 11.1		1 33.3		10	10	11	11
	Fighting				1 5.0							2 22.2				15		15	11
To maintain Personal Integrity	Impurity					1 3.2				1 4.8				1 33.3		(16)		(16) 14	
	Sloth				1 5.0	1 3.2		3 8.8										13	11
	Unconventional							2 5.9										13	
	Deceptiveness			1 4.6		1 3.2		1 2.9										11	
	Selfishness			1 4.6		1 3.2	1 3.6											11	
	Pride																		
	Cheating					2 6.5	2 7.1	1 2.9				3 33.3				15		15	12
To Animals	Cruelty			1 4.6														11	
Combination of Obligations	Intemperance																		
	Neglect Health																		
False Concepts	Religious																		
	Non-religious						1 3.6												12

TABLE NO. 101

Table No. 101 presents the results from the G. Public School group tests which were given in answer to the question, *What one action do you consider the worst a person can do during life.*

	Age	10		11		12		13		14		15		16		17		18		Ad.		Age of 10%		Age of Max.	
	Sex	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	B	B	G	B	G	B	G
	No. of Cases	8	12	19	23	38	43	50	58	55	56	42	37	25	13	6	3	3	10	4	3				
Duty: To God	Blasphemy	0	2 16.7	4 21.0	3 13.1	5 13.2	1 2.3	5 10.0	4 6.9	1 1.8	0	4 9.5	0	3 12.0	0							11	10	11	10
	Unbelieving			4 21.0	2 8.7	1 2.6	4 9.3	1 2.0	6 10.3	2 3.6	1 1.8	6 14.3	9 24.3	1 4.0	2 15.4	0	1 33.3	2 66.7	0			11	13	(18) 11	(17) 15
	Violation of Rel. Duties					0	2 4.7																		12
	Sin			1 5.3	2 8.7	4 10.5	1 2.3	5 10.0	4 6.9	5 9.1	3 5.4	6 14.3	3 8.1	0	1 7.7	1 16.7	0	0	1 10.0			12	18	17	18
To Family	Country	3 37.5	1 8.3					3 6.0	2 3.4	6 10.9	2 3.6	2 4.8	0	1 4.0	0							10		10	10
	Church																								
	School																								
	Clubs and Gangs																								
To Superiors and Friends	Contrary to Authority	1 12.5	1 8.3	0	3 13.1	1 2.6	2 4.7	2 4.0	3 5.2	0	1 1.8											10	11	10	11
	Divorce																								
	Adultery							0	1 1.7	1 1.8	0	2 4.8	0											15	18
To any Human Being	Vs. Charity					1 2.6	1 2.3	0	1 1.7	0	1 1.8	4 9.5	2 5.4							3 75.0	0	Ad.		Ad.	15
	Vs. Purity																								
	Vs. Honesty													0	2 15.4			1 33.3	0			18	16	18	16
	Stealing	3 37.5	1 8.3	2 10.5	6 26.1	5 13.2	9 21.0	9 18.0	7 12.0	5 9.1	4 7.2	2 4.8	0	2 8.0	0							10	11	10	11
	Lying	1 12.5	2 16.7					3 6.0	2 3.4	1 1.8	3 5.4	3 7.1	4 10.8					1 33.3	0	1 25.0	0	10	10	(18) 10	10
	Murder	3 37.5	0	7 36.8	6 26.1	17 44.7	18 41.9	13 26.0	22 37.8	28 51.0	21 37.6	20 47.6	9 24.3	10 40.0	2 15.4	1 16.7	1 33.3	2 66.7	0			10	11	(18) 14	12
	Fighting													0	1 7.7					1 25.0	1 33.3	Ad.	Ad.	Ad.	Ad.
To Maintain Personal Integrity	Impurity													3 12.0	0	1 16.7	1 33.3					16	(17)	17	(17)
	Sloth					1 2.6	0	1 2.0	0	1 1.8	2 3.6					0	1 33.3						(17)	12	(17) 14
	Unconventional					1 2.6	1 2.3			1 1.8	1 1.8													12	12
	Deceptiveness					2 5.3	0			1 1.8	2 3.6							1 33.3	1 10.0					(18) 12	18
	Selfishness							1 2.0	1 1.7					3 12.0	0							16		16	13
	Pride																								
	Cheating			1 5.3	1 4.4					2 3.6	1 1.8	1 2.4	2 5.4											11	15
To Animals	Cruelty																								
Combination of Obligations	Intemperance					1 2.6	0	1 2.0	0	3 5.5	2 3.6	3 7.1	1 2.7			1 16.7	0					17		17	14
	Neglect Health																								
False Concepts	Religious															1 16.7	1 33.3					17	17	17	17
	Non-religious											0	1 2.7												15

The question we will next consider approaches a limited number of the problems of childhood from a different point of view. The child is asked to

Write down the following list of faults in the order in which you think you commit them most frequently.

Selfishness, lying, cheating, stubborness, stealing, swearing, disobedience, insolence.

The question above was conceived as a possible method of getting an insight into the child's faults as the teacher sees them, and of comparing them with his faults as he himself sees them. With this end in view a request was sent to several teachers personally interested in the problem, asking them to keep a record of the faults committed in their classroom for one month, noting the frequency with which these faults occurred. High School teachers found the undertaking almost impossible because of the constant changing of classes and because, also, children of this age succeed in hiding, while in the classroom, practically all faults beyond an occasional offense against discipline. Results were received from ten teachers—three from the fifth grade, four from the sixth, one from the seventh, one from the eighth, and one from High School. The faults mentioned rank as follows:

(1) *disobedience*
(2) *cheating*
(3) *selfishness*
(3a) *inattention*
(4) *lying*
(5) *stubborness*
(5a) *pouting*
(6) *insolence*
(7) *stealing*
(8) *swearing*

It was considered that "inattention" and "pouting" were not sufficiently important, morally, to seek results on them in our tests. Therefore, the list as presented, included the remaining eight given in an order different from that in which the teachers ranked them.

Table No. 102 presents for the boys and girls of four school systems at each age, the number and percentage ranking the respective faults first. Thus if we consider lying at the age of 13, we find that of the subjects from G. Public schools, 6 boys and 5 girls, 14.6 and 10 percent respectively, consider this the fault they commit most frequently; of the P. Public school subjects

2 boys and 4 girls or, 5.9 and 14.8 percent, consider it so; of the Catholic school subjects 22 boys and 10 girls or, 16.7 and 12.8 percent respectively accuse themselves of this as their greatest fault.

If we compare the predominant fault for each age in these Tables with the list of faults as observed by the teachers, the following points may be noted. *Disobedience* is named first by the teachers and predominates as the first fault in 28 of the 51 groups recorded. Boys and girls are equally disobedient if we may judge from their parallel records. Teachers name *cheating* as the fault second in importance, but neither boys nor girls of any age group except at adult age where one person mentions it, admit that cheating is their predominant fault. *Selfishness* is ranked third by the teachers and also holds third place in the ranking of the children as a predominant fault, being mentioned at eight ages, six of which were girls. *Lying* is ranked fourth by teachers and also fourth by the pupils. The boys are more conscious of the tendency to lie than are girls. *Stubbornness* holds fifth place in the estimation of the teachers, but it is second as the child sees himself. With this fault, also, boys and girls have parallel records. Teachers rank *insolence* next, and it occupies sixth place also in the pupil's record being mentioned by one age group. *Stealing* ranks seventh in the estimation of the teachers but is not mentioned by any age group of subjects as a predominant fault. *Swearing* is placed last in rank by the teachers; it ranks fifth with pupils. It is named at five age groups but by boys only—girls evidently are not so prone to this fault.

The list of faults was then taken and the number of times a fault was mentioned calculated, without reference to how the child ranked it. This total served as the basis of re-ranking the faults for each age. Tables No. 103 and 104 give the fault (or faults) which after this sum had been calculated, ranked first at each age together with the number of cases mentioning it and the percentage this number is of the whole group.

TABLE NO. 102

The faults as ranked first by the children.

Age	Fault School	Selfishness B	 G	Lying B	 G	Cheating B	 G	Stubbornness B	 G	Stealing B	 G	Swearing B	 G	Disobedience B	 G	Insolence B	 G
10	G. Public	3 50.0	3 30.0	0 .0	2 20.0	0 .0	1 10.0	1 16.7	3 30.0	0 .0	0 .0	0 .0	0 0	2 33.3	0 .0	0 .0	0 .0
	P. Public	5 38.2	2 14.3	0 .0	0 .0	0 .0	0 .0	3 23.1	0 .0	0 .0	0 .0	0 .0	0 .0	2 15.4	3 21.4	1 7.7	0 .0
	Catholic	13 18.3	3 5.0	17 24.0	12 20.0	2 2.8	0 .0	5 7.1	7 11.7	1 1.4	1 1.7	2 2.8	0 .0	5 7.1	10 16.7	0 .0	0 .0
11	G. Public	4 30.8	6 30.0	0 .0	1 5.0	0 .0	1 5.0	4 30.8	6 30.0	0 .0	0 .0	0 .0	0 .0	2 15.4	3 15.0	0 .0	2 10.0
	P. Public	5 22.8	7 35.0	2 9.1	1 5.0	0 .0	0 .0	5 22.8	6 30.0	1 4.6	0 .0	1 4.6	0 .0	6 27.3	2 10.0	2 9.1	1 5.0
	Catholic	12 13.8	14 12.5	20 23.0	28 24.9	3 3.5	0 .0	4 4.6	10 8.9	3 3.5	1 0.9	2 2.3	2 1.8	11 12.7	16 14.2	2 2.3	1 0.9
12	G. Public	10 32.3	14 32.3	1 3.2	0 .0	3 9.7	2 5.9	8 23.8	10 29.4	0 .0	1 2.9	2 6.5	0 .0	5 16.2	5 14.7	1 3.2	1 2.9
	P. Public	6 19.4	5 17.9	4 12.9	2 7.1	0 .0	0 .0	8 25.8	5 17.9	0 .0	1 3.6	2 6.5	1 3.6	4 12.9	5 17.9	0 .0	1 3.6
	Catholic	17 18.4	18 18.0	25 27.0	16 16.0	12 13.0	1 1.0	8 8.6	12 12.0	21 22.7	2 2.0	6 6.5	1 1.0	10 10.8	27 27.0	0 .0	0 .0
13	G. Public	8 19.5	16 32.0	6 14.6	5 10.0	1 2.4	1 2.0	12 29.3	14 28.0	1 2.4	0 .0	3 7.3	1 2.0	7 17.1	6 12.0	0 .0	0 .0
	P. Public	3 8.8	3 11.1	2 5.9	4 14.8	0 .0	0 .0	11 32.3	7 25.9	0 .0	0 .0	3 8.8	0 .0	5 14.7	8 29.6	3 8.8	0 .0
	Catholic	21 16.0	12 15.4	22 16.7	10 12.8	4 3.0	0 .0	13 9.9	15 19.2	0 .0	0 .0	11 8.4	0 .0	26 19.8	26 33.3	2 1.5	0 .0
14	G. Public	10 21.3	11 30.6	5 10.7	2 5.7	0 .0	1 2.8	6 12.8	10 27.8	1 2.1	1 2.8	4 8.5	0 .0	10 21.3	4 11.1	2 4.3	2 5.6
	P. Public	0 .0	3 23.1	2 9.5	2 15.4	0 .0	0 .0	3 14.3	5 38.5	0 .0	0 .0	4 19.0	0 .0	5 23.8	0 .0	0 .0	0 .0
	Catholic	17 11.6	23 15.6	28 19.0	16 10.9	1 0.7	1 0.7	22 15.0	19 12.9	3 2.0	1 0.7	12 8.2	1 0.7	23 15.6	46 31.3	2 1.4	1 0.7
15	G. Public	9 23.0	9 32.1	4 10.2	1 3.6	0 .0	0 .0	11 28.2	11 39.3	0 .0	0 .0	2 5.1	0 .0	10 25.6	6 21.4	1 2.6	0 .0
	P. Public	1 11.1	0 .0	1 11.1	0 .0	0 .0	0 .0	1 11.1	1 50.0	0 .0	0 .0	1 11.1	1 50.0	3 33.3	0 .0	1 11.1	0 .0
	Catholic	15 10.5	32 17.6	23 16.1	14 7.7	2 1.4	1 0.6	16 11.2	35 19.3	1 0.7	2 1.1	25 17.5	3 1.7	25 17.5	68 37.4	2 1.4	2 1.1
16	G. Public	1 5.9	1 12.5	4 23.5	1 12.5	0 .0	0 .0	6 35.3	3 37.5	0 .0	0 .0	2 11.8	1 12.5	3 17.6	2 25.0	1 5.9	0 .0
	Catholic	9 13.7	18 14.9	16 24.3	5 4.2	1 1.5	1 0.8	9 13.7	26 21.6	0 .0	2 1.7	13 19.8	0 .0	11 16.7	44 36.5	0 .0	2 1.7
17	G. Public	1 14.3	1 33.3	1 14.3	0 .0												
	Catholic	3 7.0	17 24.3	10 23.3	4 5.7	0 .0	0 .0	4 9.3	12 17.2	0 .0	1 1.4	4 9.3	1 1.4	7 16.3	24 34.3	1 2.3	2 2.9
18	G. Public	4 50.0	0 .0	0 .0	1 33.3	0 .0	1 33.3	2 25.0	1 33.3	0 .0	0 .0	1 12.5	0 .0	0 .0	0 .0	0 .0	0 .0
	Catholic		3 12.5		2 8.3		0 .0		5 20.9		0 .0		0 .0		7 29.2		1 4.2
Ad.	G. Public	1 25.0	1 33.3	2 50.0	0 .0	0 .0	0 .0	0 .0	1 33.3	0 .0	0 .0	1 25.0	0 .0	1 25.0	1 33.3	0 .0	0 .0
	Catholic		8 61.5		0 .0		0 .0		2 15.4		0 .0		0 .0		2 15.4		0 .0

TABLE NO. 103 (BOYS)

The fault named by the greatest number of children at each age.

	G. Public			P. Public			Catholic		
Age	Name	No.	%	Name	No.	%	Name	No.	%
10	Selfish, Disobey	4	66.7	Disobey	9	69.2	Lie	37	52.2
11	Stubborn	9	69.2	Disobey	20	91.0	Disobey	46	52.9
12	Stubborn	24	77.5	Disobey	20	64.6	Lie	56	54.3
13	Stubborn, Disobey	32	78.1	Stubborn	19	55.9	Disobey	87	66.1
14	Stubborn	36	76.7	Disobey	13	61.9	Disobey	88	59.8
15	Disobey	34	87.0	Swear	8	88.9	Disobey	95	66.5
16	Stubborn, Swear	15	88.2				Disobey	55	83.6
17	Lie, Stubborn, Disobey	5	71.5				Swear	28	65.2
18	Swear, Selfish	7	87.5						
Ad.	Lie, Cheat, Swear, Disobey	4	100.0						

TABLE NO. 104 (GIRLS)

	G. Public			P. Public			Catholic		
Age	Name	No.	%	Name	No.	%	Name	No.	%
10	Stubborn	8	80.0	Disobey	5	35.7	Disobey	27	45.1
11	Selfish, Stubborn, Disobey	18	90.0	Stubborn	14	70.0	Disobey	64	57.0
12	Stubborn	29	85.3	Disobey	17	60.7	Disobey	67	67.0
13	Selfish	36	87.8	Disobey	19	70.3	Disobey	56	71.7
14	Disobey	30	83.4	Stubborn	9	68.6	Disobey	104	70.7
15	Selfish	28	100.0	Disobey	2	100.0	Disobey	147	80.9
16	Stubborn	8	100.0	Selfish, Lie, Stubborn	1	50.0.	Disobey	91	75.5
17	Selfish, Insolent	2	66.7				Disobey	57	81.5
18	Insolent	3	100.0				Disobey	30	15.5
Ad.	Selfish, Lie, Stubborn	3	100.0				Disobey	12	92.3

This data may be made more clear by the following schema:

Fault	Disobedience	Stubbornness	Selfishness	Lying	Swearing	Insolence	Cheating	Stealing
Rank by Pupil	1	2	3	4	5	6	7	7
Rank by Teacher	1	5	3	4	8	6	2	7

The results attained through this subjective and objective method of ranking have a rough agreement, giving a correlation of 48. We may note, however, that while very often we consider "cheating" and "stealing" as great failings with the child, and although he expresses a dislike for them as things bad-to-do,[2] yet he does not accuse himself of them. Certainly they are important and condemned qualities in his moral code.

Cheating seems to be the only fault which differs in rank to any extent, as arranged by pupils and teacher. As cheating is a fault which we assume belongs to the class-room chiefly, the teachers' observation must be worth much. In the tables giving things which the child considered bad-to-do, cheating, as was mentioned above, holds an important place. Therefore the child knows it is wrong, yet he ranks it seventh in the list of faults given; that is, he cheats but rarely. On the contrary, the teacher ranks it second; that is, it is one of the great faults of the schoolroom. In order to ascertain if possible, the cause of this discrepancy, several Grammar Grade teachers were asked to define by examples what they understood by cheating. A few children from the classes of these teachers were asked to write a composition on "What I think cheating means." No further suggestions were given the child. The answers show an enlightening point of difference in the concept of teacher and child in regard to cheating. The teacher looks upon cheating as any petty unfairness in or about the class-room. She, therefore, includes under it a large number of acts. The child regards cheating as a serious offense and therefore, attributes it only to big acts, *i.e.*, copying during examination, or doing something cowardly to keep out of trouble. This difference of opinion concerning the seriousness of cheating explains very well why, considered objec-

[2] See inserts, Tables 94 through 101.

jectively, the child cheats a great deal, while considered subjectively, he commits this fault but rarely.

No opposition was offered by the public school children to the request for self-analysis in these questions, but such was not the case in the Catholic schools. The children in general, but especially the boys, objected to writing out "their confession" for someone to read. In order to gain any response at all to the question, it was necessary to promise that their teachers would not examine the papers and to point out that their answer would be only one in thousands when the papers came to be corrected. With these assurances they went seriously about what they evidently regarded as a very disagreeable task. The experience in introspection which their religious practices of examination of conscience and of confession give them, should insure more exact results from these children than from the public school subjects. The value of the results must be discounted, however, because of their dislike for the task and in many cases the refusal to carry it beyond the first or second fault. Probably, because of the novelty of the task, the public school children did not regard the problem as so personal a one.

We may summarize the results of this test thus: (1) disobedience is the predominant fault of most children; (2) both children and teachers are equally cognizant of the rôle selfishness, lying, and insolence play in the child's life; (3) teachers are too severe in their judgments of children with regard to cheating; (4) teachers are not wholly conscious of the importance of stubbornness and swearing in the life of their pupils; (5) stealing is rather an infrequent fault of children.

CHAPTER VIII

The Stages of the Moral Development of Children

Let us assume as a working basis for the consideration of the problems presented in the last chapter that most children are not alive to moral problems before the age at which the problems first appear in our tests. This assumption is justified by the fact that the children taking the tests were unselected groups of all ages and of all social conditions. We may then deduce the pedagogical corollary that it is vain to give moral instruction in these problems before the age at which children in general commence to be aware of them.

Let us assume a further principle: most children have for some reason ceased to be keenly alive to moral problems after the age at which the problems last appear in our tests. This does not mean that the children have ceased to be able to judge correctly on these questions but merely that the problems in question are not seriously troubling their mind. We may then deduce a second corollary: that it is useless to give moral instruction on these problems after the age at which children in general have lost interest in them. Obviously, then, the time for instruction in any moral problem is at that period when the child is interested therein, and it should be graded to follow this natural interest of the child.

These tests ask for spontaneous statements of things that are morally right or wrong. If a moral problem does not come up in the mind of any child of a given age taking the tests it is because children of this age are in general ignorant of it entirely; or because it is so far in the background of their mental activity at that age that it does not occur to them. Moral problems about which children think are likely to be mentioned—unless the mentioning of them on paper is inhibited, *e.g.,* by a sense of shame. For this reason sex problems are mentioned less frequently than others. The questions naming the best and the worst actions

one can do during life are not, however, so likely to lead to the mentioning of the actual living moral problems. Thus a considerable percentage of children, mention "murder" as the *worst action a person can do during life.* It is evident that this is not due to any actual moral conflict about murder in the mind of these children. The question, however, asking the child to *name three things it is good-to-do,* is likely to lead to moral problems about which the child himself has had some experience.

Moral problems make their first appearance as follows:

Age 6-7. Religious acts; personal piety; divine worship; respect for authority (in the family); charity; gentleness; honesty; physical exercise; duty to school; to be honorable (girls); to be unselfish (girls); self-denial (boys).

Age 8-10. Render assistance at home; follow vocation; politeness; purity; courtesy (boys); unselfishness (boys); courage (boys); cheerfulness (girls); self-denial (girls).

Age 11-12. Preservation of health; courtesy (girls); duty to country (boys); duty to church (boys); cheerfulness (boys); industry (girls).

Age 13-14. Duty to country (girls); gratitude (girls).

Age 15-16. Industry (boys).

Age 17-18. Gratitude (boys).

The above schema was drawn from the answers on the Catholic school papers to the questions *Name three things it is good-to-do,* and *What one action do you consider the best a person can do during life?*

It will be noted that after 12 years very few new moral problems are mentioned. This does not mean that at 12 all children are aware of practically all the problems, but that in a large, representative group of children a few are aware of most of the moral problems. Our points of appearance give the age at which the most precocious child in the group becomes aware of any problem. The age at which the average child becomes aware of it will, of course, be later, and may be found by tracing the growth of this problem in the tables. The points of disappearance, likewise, do not represent the time at which this problem ceases to be vital in the life of the average child, but rather the age at which the most retarded child fails to mention it. Thus we include in our points of appearance and of disappearance all the

ages at which a problem appears and continues to be active in the mind of any child in the group.

The schema outlined above indicates a central tendency for three stages of moral development worthy of consideration. In the first stage, it is duty to God; in the second stage, it is duty to one's neighbor and the duty of the individual to maintain his personal integrity; in the third stage, it is the relationship of the individual to the larger social groups, his vocation in life, his duty to the church and to his country. It is very likely that these three stages are not accidental in the moral relationship of the individual to his environment.

An analysis of the points of disappearance of the moral problems as revealed in the answers of these children is presented in the following schema:

The minimum age of disappearance is 10—after which courage and physical exercise are not mentioned.

11-12. Duty to country (girls).

13-14. Courtesy (boys).

15-16. Duty to school (girls); politeness (girls); preserve health (girls); unselfishness (girls).

17-18. Worship (boys); follow vocation; duty to country (boys); go to school (boys); render assistance (boys); courtesy (girls); gratitude; charity (boys); politeness (boys); cheerfulness; purity; preserve health (boys); to be honorable (boys); honesty; self-denial (boys); unselfishness; industry.

Religious acts; personal piety; worship (girls); respect for authority; render assistance at home (girls); charity (girls); gentleness; to be honorable (girls); and self-denial (girls), persist in the adult period[1]

The points of disappearance of these problems do not give the same grouping as do the points of appearance. This is due, perhaps, to the difference in the length of time that these problems remain active in the moral consciousness of our subjects. The religious problems once having been awakened, remain active throughout adolescence and even into adult years.

Let us now consider the appearance of moral problems (as indicated by the answers to the question asking for *three things good-to-do,* and for *the best thing we can perform during life*) for the public school children.

[1] That purity is not mentioned at this age may mean either sensitiveness on this point, or that it is so basic a virtue that it is taken for granted.

P. Public	G. Public
Appearance at:	
10, or before:	
Religious acts	Religious acts
Personal piety (boys)	Personal piety (boys)
Divine worship	Divine worship
Respect for authority	Respect for authority
Render assistance (boys)	Charity
Courtesy (boys)	Politeness (girls)
Charity	Cheerfulness
Gentleness	Gentleness
Purity (boys)	To be honorable
To be honorable	
Honesty	
Industry (boys)	
11-12:	
Personal piety (girls)	Personal piety (girls)
Follow vocation	Follow vocation
To go to school	To country (boys)
Courtesy (girls)	To go to school
Preserve health (boys)	Render assistance
To be unselfish (boys)	Preserve health (boys)
Recreation (girls)	Honesty
	Unselfishness (boys)
	Industry (girls)
	Recreation (boys)
13-14:	
To country	Follow vocation (girls)
To render assistance (girls)	To country (girls)
Gratitude (boys)	Recreation (girls)
Politeness	Have a trade
Cheerfulness	Courtesy
Purity (girls)	Politeness (boys)
Mortification (boys)	Purity
Recreation (boys)	Preserve health (girls)
	Unselfishness (girls)
	Industry (boys)
	Mortification (boys)
15-16:	
Physical exercise	

It is impossible for us to investigate at this time, the moral problems of public school children from 6 to 10 years of age. Children do not read well enough until they reach 10 years to take the group test and the opportunity of giving the tests individually, did not present itself.

If, however, the moral problems of 6-10 are religious problems in the public schools, it is likely that they will be mentioned in the answers of the 10-year-olds at which age our investigation commences. This, as a matter of fact, we find to be true. All the problems occurring in the public school papers at 10 and so present at 10 or before, are mentioned before this age in the papers from the Catholic schools. However, not all problems which make their appearance at 10 or before in the Catholic school papers are found in the 10-year-old groups of public school children, although they appear at later ages. A sufficiently large number of problems appear in the public school outline at the identical age at which they appear in that of the Catholic schools, however, to let us assume that the differences between the groups are not very great. The problems appear also at practically parallel ages for the two Public School systems.

The first stage of moral development found in the child, from the Catholic school namely, that of the recognition of duty to God, is evidently among the first, if not the first, to appear with these children. Problems belonging to the second stage, duty to one's fellowman and to maintain one's personal integrity occur at all the ages, but the majority of these make their appearance earlier than do the majority of those belonging to the third stage —namely, duties to various social groups. Thus, we may say that these problems fall roughly into the three stages of development found in the Catholic school papers.

The points of disappearance of the various problems in the public school systems as shown in the outline below, exemplify the tendency of religious duties to persist all through the adolescent period, while duties to social groups, to mankind, and to self disappear more or less, irregularly.

Points of Disappearance

P. Public	G. Public
10, or before:	
Courtesy (boys)	
11-12:	
Follow vocation (girls)	
Courtesy (girls)	
Gratitude (girls)	
Preserve health (boys)	
Courage (boys)	
13-14:	
Personal piety	To country (girls)
Divine worship (girls)	To go to school (girls)
Purity (girls)	Cheerfulness (girls)
Self-denial (boys)	Industry
Unselfishness (boys)	
Industry (boys)	
Follow vocation (boys)	
To country	
To go to school	
To render assistance	
Gratitude (boys)	
Politeness (boys)	
Cheerfulness	
Recreation	
15-16:	
Religious acts (16)[2]	Personal piety (girls)
Divine worship (boys)	Have a trade
Respect for authority (16)	Follow vocation (girls)
Charity (girls 16), (boys 15)	To go to school (boys)
Politeness (girls)	Render assistance (girls)
Gentleness (16)	Courtesy (girls)
Purity (boys 16)	Preserve health (girls)
To be honorable (girls 16), (boys 15)	To be honorable (girls)
Honesty	Self-denial (boys)
	Unselfishness (girls)
	Physical exercise
	Recreation

[2] The number following the action in this group indicates the year at which it was last mentioned. No subjects above the age of 16 were tested in this school.

G. Public
17-18
Religious acts (boys)
Follow vocation (boys)
Respect authority (girls)
Render assistance (boys)
Politeness
Cheerfulness (boys)
Purity
Preserve health (boys)
To be honorable (boys)
Unselfishness (boys)
Persisting in Adult Age:
Religious acts (girls)
Personal piety (boys)
To country (boys)
Respect for authority (boys)
Courtesy (boys) Gentleness
Charity, honesty

In answer to the questions, *Name three things it is bad-to-do,* and, *What one action do you consider the worst a person can do during life,* the Catholic school papers show that the moral problems present themselves for the first time at the various ages as follows:

6-7. Blasphemy; unbelief; violation of religious duties; against school; contrary to home authority; against charity; stealing; lying; murder; fighting; selfishness (girls); discourtesy (girls); against country (boys); pride (boys); and laziness (boys).

8-10. Against purity; cruelty; impurity; against country (girls); pride (girls); against conventions (girls); against honesty (girls); intemperance (girls); deceptiveness (girls); cheating (boys); discourtesy (boys); selfishness (boys).

11-12. Divorce (girls); laziness (girls); intemperance (boys).

13-14. Adultery (girls); deceptiveness (boys); neglect vocation (boys).

15-16. Neglect vocation (girls); adultery (boys).

As was the case with the problems in the table dealing with the *acts it is good-to-do,* it is found that practically all problems are mentioned by the end of the twelfth year. Only the two exceptions, "neglect of vocation" and "adultery" present themselves after this age.

The problems classify themselves also into the three stages of moral development noted above. In the first stage, are included violation of duties to God,—blasphemy, unbelief, and violation of religious duties. Only the percentage of children mentioning them at the youngest age tested, offers any indication of which concept appears first.

Exception may be taken to this outline of the three stages of moral development because the presence of "violation of duties to school" and of "actions contrary to home authority" appear at an early age in our Table, but if we analyze the nature of these acts as mentioned by the 6-year-olds we find that they are really directed against an individual who does not represent a social group to the child.

The third stage of development is rather poorly defined here. If we consider divorce and adultery, crimes against the family as a social institution, and intemperance and neglect of vocation as detrimental to the welfare of society the problems as they appear, fit into the classification very well. However, it is doubtful whether the child had anyone more than the individual in mind when he mentioned these actions. Indeed, it is not strange, that actions contrary to a social group, *e.g.*, against country, or church, or school, should not present themselves in this third stage because in actual life children do not have an opportunity of doing anything contrary to these duties.

The following outline presents the ages at which these same problems appear in the papers of the public school children.

The problems appear for the two Public School systems at practically the same ages, but these ages are later in many cases than those found in the Catholic schools. We find, also, that the third stage development in the public school is practically non-existent and its absence may be accounted for, as in the previous case, by the fact that children do not commit offenses against society or against their country. Moreover, we find relatively the same order of appearance here as in the Catholic schools.

P. Public

10, or before:
Blasphemy
Lying
Murder
Fighting (boys)
Cheating
Stealing
Against charity
Adultery (boys)
Against conventions (boys)
Contrary to authority
Unbelief (girls)
Violation of religious duties

11-12:
Unbelief (boys)
Discourtesy (girls)
Fighting (girls)
Impurity
Laziness
Against conventions (girls)
Deceptiveness (boys)
Selfishness
Pride (boys)
Cruelty
Intemperance

13-14:
Neglect vocation
Adultery (girls)
Against honesty (girls)

G. Public

Blasphemy
Violation of religious duties
Against country
Contrary to authority
Discourtesy (girls)
Against charity (girls)
Stealing
Lying
Murder
Fighting (girls)
Deceptiveness (boys)
Cheating

Unbelief
Against charity (boys)
Against honesty (girls)
Fighting (boys)
Laziness (boys)
Against conventions
Selfishness (boys)
Cruelty
Intemperance

Adultery
Discourtesy (boys)
Against charity (boys)
Laziness (girls)
Selfishness (girls)
Pride (girls)

15-16:
Impurity

17-18:
Against honesty (boys)

Let us now consider the ages at which the various problems tend to disappear in the answers of the parochial school children:

11-12. Divorce (girls).

13-14. Pride (girls); cruelty (girls); against school (boys).

15-16. Neglect vocation (boys); against school (girls); adultery (girls); discourtesy (girls); laziness (girls).

17-18. Fighting; impurity; aganst conventions; against purity; selfishness; intemperance; neglect vocation (girls); against honesty (girls); laziness

(girls); cheating (girls); against country (boys); deceptiveness (boys); cruelty (boys); unbelief (boys).

The moral problems persisting in adult years are: blasphemy; violation of religious duties; contrary to authority (girls); unbelief (girls); against charity; stealing; lying; murder; pride (girls); cheating (boys); adultery (boys).

A comparison of the points of appearance and the points of disappearance bring out a tendency which is also present in the things it is good-to-do, namely that the problems disappear in the reverse order to that in which they appear. As was noted previously in the case of the good and best actions, the small number of boys taking the test at the adult age probably causes more problems to disappear at 17-18 for the boys than would otherwise be the case.

The problems tend to disappear in the answers of the public school children as outlined below.

The large number of problems which disappear from the P. Public schools in the 15-16-year-old group is very marked. This is due to the fact that in this school system the tests were carried through the Eighth Grade only. The small number of cases at 15-16 therefore, are hardly representative.

There are several interesting points of comparison between this outline of the public school children which gives the ages at which certain moral problems cease to be active in their minds, and the corresponding outline for the parochial school children. The awareness of problems concerning the violation of the duty one has to maintain his personal integrity, disappears for both groups at the 17-18-year-old period. Whereas, in the Catholic school answers, the consciousness of a duty one has not to violate his obligations to God persists into the adult age, this concept disappears earlier from the minds of the public school children. They retain, however, in the adult period a greater consciousness of those things which would violate a duty to one's neighbor, than do the parochial school children. It may be assumed, that as environment offers these public school subjects their moral training in most cases, the ideal of one's duty to his neighbor has superseded that of one's duty to God.

P. Public	G. Public
10:	
Adultery (boys)	
11-12:	
Laziness (girls)	
Selfishness (girls)	
Pride (boys)	
Cruelty	
Intemperance (girls)	
13-14:	
Unbelief	Against country (girls)
Violation of religious duties	Adultery (girls)
Neglect vocation	Discourtesy (boys)
Adultery (girls)	Pride (girls)
Discourtesy (girls)	
Murder (girls)	
Fighting (girls)	
Impurity (girls)	
Against conventions (girls)	
Deceptiveness (boys)	
Selfishness (boys)	
Intemperance (boys)	
15-16:	
Blasphemy (boys 16)	Violation of religious duties (boys)
Contrary to authority (girls 16)	Against country
Against charity (girls 16)	Against charity
Stealing (16)	Against honesty (girls)
Lying (16)	Impurity (boys)
Murder (boys 16)	Laziness (boys)
Fighting (boys 16)	Against conventions
Impurity (boys 16)	Intemperance
Laziness (boys)	Selfishness
Against conventions (boys 16)	Cruelty (girls)
Cheating (girls 16)	
	17-18:
	Blasphemy (girls)
	Unbelief
	Violation of religious duties (girls)
	Adultery (boys)
	Discourtesy (girls)
	Against honesty (boys)
	Murder (girls)
	Impurity (girls)
	Laziness (girls)
	Deceptiveness (boys)
	Cheating (girls)
	Cruelty (boys)

No attempt has been made in the above analysis to consider the separate actions from the standpoint of their importance as suggested in the percentages at the various ages. This can be worked out readily from the Tables, in Chapter VII, if so desired. Nor has any definite attempt been made to find what difference in meaning a term may have at various ages, *e.g.*, how the religious act at 6 differs from that of 16, or what objects are stolen at 8 as compared with those stolen at 12. Such a study were it attempted, would undoubtedly yield valuable results.

CHAPTER IX

The Moral Principles of Children

A number of moral principles were considered in detail when we discussed the results of the pictures and stories. These principles while interesting in this detailed form, do not enable us to form a general survey of children's ideals. It has been considered worth while, therefore, to attempt a generalization of these moral principles based on the schema explained and used in Chapter VII, on the Moral problems of childhood.[1]

The problems presented in these stories differ from those in the questions, *Name three things it is good-to-do,* etc., in that we suggest a situation in the stories and ask for a solution. The child then draws on his store of principles for one that will solve the problem. In the other case, the question gave no suggestion but demanded rather the spontaneous reaction of the child, and in his reply we were justified in expecting to find the statement of those ideals which were uppermost in his mind. Many other principles and ideals undoubtedly were present also, and it was to give him an opportunity of expressing these that he was presented with definite problems to solve.

The following classification will be used in discussing the points of appearance and of disappearance of these principles. After each specific principle will be given the story or picture in which it is mentioned.

Duty to God.

Concept of worship (Story No. 6).
Aim of life—happiness versus pleasure (Story No. 14).
Obligation to go to church (Picture No. 6).
Belief in the supernatural, appearance of Guardian Angel, etc. (Picture No. 8).
Obligation to respect man as a work of God (Story No. 2).

[1] See p. 137.

Duty to Social Groups.

To the State.

Duty in time of war (Story No. 10).
Necessity of justice (Story No. 15).
Right of property (Stories No. 7 and 8 and Pictures No. 1 and 2).
Eviction—a legal tragedy (Picture No. 4).
Mob rule (Story No. 12).
Capital punishment, a right of the State (Story No. 12).
Obligation of the State to censor amusements (Story No. 16).

Duty to the Family.

Obedience (Story No. 1).
Duty to help mother (Story No. 4).
Love of mother (Story No. 4).
Relative importance of duty to father and to State in a crisis (Story No. 10).
Obligations of an adopted child (Story No. 15).
Son harming his mother (Picture No. 4).

Parental love.

Mother instinct and love for her child (Picture No. 4).
Cruel husband and father—due to drink (Picture No. 4).

Permanency of the family unit.

Sacredness of marriage (Story No. 4).
Marital infidelity (Picture No. 7).
Divorce (Story No. 14).

Duty to superiors and friends.

Respect for elders (Story No. 5).
To be polite (Stories No. 3 and 5).

Duty to any human being.
- Charity (Stories No. 2 and 5).
- Gossip (Picture No. 8).
- Eavesdropping (Picture No. 8).
- Jealousy (Picture No. 8).
- Snobbery (Picture No. 8).
- Make fun of a person (Stories No. 2, 4, and 5).
- Hurt another's feelings (Stories No. 2, 4, and 5).

Charity.
- Tactless frankness (Story No. 9).
- Telling the truth and injuring another's reputation (Story No. 11).

Purity.
- Demoralizing shows (Story No. 16).
- Obligation of society to protect women from immoral conditions (Story No. 16).
- Obligation of the individual to observe conventions guarding sex (Story No. 13).
- Moral indignation aroused in white men at assault on a member of their race by a negro (Story No. 12).
- Double standard of morality for men and women (Story No. 16).
- Stealing (Stories No. 7 and 8; Picture No. 1 and 2).
- Murder (Pictures No. 3 and 4).

Obligation to maintain one's personal integrity.
- To be moral.
  - Modesty (Picture No. 8).
  - Immature love (Picture No. 6).
  - Flirting (Picture No. 6).
- To be honorable.
  - Truthfulness (Stories No. 9 and 15).
  - Obligation to keep a promise (Story No. 11).

Courtship.
  Selfishness (Story No. 3).
Gambling.
  Playing cards (Picture No. 3).
  Playing dice (Picture No. 4).

In considering the points of appearances of these principles we will classify them according to that group of duties to God, self, or some social group under which they have been placed in the above outline.

The principles exemplified in the stories and pictures presented to the children, were first perceived by them at the following ages:

Points of Appearance.

6-7:
Respect for authority
Charity
Unselfishness
Duty to help mother
Respect for elders
To be polite
Worship
Stealing

10:
Duty in time of war
Sovereign power belongs to State alone
Indissolubility of marriage (boys)
Divorce (boys)
Necessity of justice (girls)
Purity
Stealing (shoplifting) (boys)

11-12:
Regard for conventions guarding sex
Appreciation of sex differences

8-9:
Religious obligations
To be moral
Courtship
Marital infidelity
Love of mother
Obligation to restore stolen goods
To be honorable
Right of mob rule
Aim of life—true happiness
Indissolubility of marriage (girls)
Divorce (girls)
Necessity of justice (boys)
Stealing (shoplifting) (girls)
Stealing (pickpocketing)
Gambling
Murder
Parental love

The recognition of principles that have to do with duty to God appears early. The simpler social duties as charity, politeness, honesty, respect for authority, etc., also appear at an early age. A second stage is perceived in the awareness of the subject to the

more complex social duties, as problems of marriage and family relations, purity as it concerns society, and realization of different kinds of murder. In this stage also may be placed the appearance of the duty the individual feels to maintain his personal integrity. This is exemplified in his desire to be honorable and to be moral. A third stage is shown in his realization of the rights and powers of the State and the obligations he has toward the State. A fourth stage which appears for the first time in our study of the moral development of the individual, is his ability to recognize and solve problems involving a sexual element. The factors which have appeared before this time have not contained any definite appreciation of sex relations or of the regulation of society to guard such relations. Purity, morality, clean thoughts, etc., as they have appeared from time to time have been classified under one's duty "to maintain his personal integrity." To look at bad pictures, tell obscene stories, go to bad plays and the like have been classified under "actions against purity" in the category of one's duties to any human being, while adultery has been placed under one's duty "to the family." Though in all these cases we do get a more or less definite sexual element it has always been up to this time subjective and has represented very little appreciation of the social aspect of sex problems. In the fourth stage which has been revealed by the child's solution of problems involving sex elements, we find that he not only appreciates the problems of sex, but that he is aware that they are problems which concern society as a whole and to control which society has built up a mass of conventions which cannot be broken down nor violated with impunity .

Considering the stages of development outlined above, we find that they coincide roughly with those found to exist when the child answered spontaneously what actions he considered good-to-do and what actions bad-to-do. When we consider the freedom of the child's choice in the one case and limitation of this choice to a single theme in the other, we may conclude that these stages of development are representative and fundamental in the progress of the individual from infancy to maturity.

The knowledge of the moral principles involved in the stories and the ability to apply them in the situation presented is shown to increase as we approach the adult age. A study of the points of disappearance in this case shows practically nothing. It was found that from 17-18, respect for man as God's handiwork (boys), duty to help mother (boys), to be polite (boys), and divorce (girls), disappeared. The small number of boys taking the test in the adult age render these results practically worthless, however. We may assume that had we a sufficient number of boys, as we have in the case of the girls, these qualities would persist for them also. We do have evidence of a modification and development of moral principles in the child—for instance, stealing (a boy's prank) is condemned at 6-7, stealing (pick-pocketing) at 8-9, stealing (an obligation to return stolen goods) at 8-9, stealing (shoplifting) at 8-9 for girls and at 10 for boys. As his experiences become greater, the development of the child is apparent, but we have no evidence that he forgets or loses a moral principle once instilled in his mind. The mechanism of the child's mind, having been attuned to a moral principle, is thrown into action at once with the presence of circumstances involving this principle.

The principles which have appeared in the child's solution of the problems involved in these stories and pictures, and the problems extemporaneously expressed by the child and considered in the previous chapter, have formed the basis of the following outline for a course in moral instruction:

Age 6-7. Grades 1 and 2.

Man has a moral duty to pray and to reverence the name of God.
" " " " " " obey.
" " " " " " respect the person of others (not to steal, not to fight).

Age 8-10. Grades 3 and 4.

Man has a moral duty to worship God and to perform acts of religion.
" " " " " " be generous.
" " " " " " show consideration for others (to be polite, gentle, courteous, truthful).
" " " " " " be pure of heart.

Age 11-12. Grades 5 and 6.

Man has a moral duty to worship God.
" " " " " " perform acts of self-sacrifice.
" " " " " " his country and to his school.
" " " " " " be pure in thought and action.
" " " " " " preserve his health.
" " " " " of charity.

Age 13-14. Grades 7 and 8.

Man has a moral duty to worship God.
" " " " " " perform acts of self-sacrifice.
" " " " " " his country.
" " " " " " his home (to uphold its authority whenever necessary).
" " " " " of charity (to love his neighbor).

Age 15-16. High School (1st and 2nd years).

Man has a moral duty to follow his vocation (to take up a life-work to which he feels called).
" " " " " " society (social, civil, and industrial).
" " " " " " be pure in all his social relationships.

Age 17-18. High School (3rd and 4th years).

Man has a moral duty to apply his religious principles in all his relations with his fellow-men.
" " " " " of charity (a combination of his duty to individuals and to social groups).
" " " " " to maintain his personal integrity in his private and public life.

CHAPTER X

A LIST OF MORAL TESTS FOR CHILDREN STANDARDIZED BY AGE.

YEAR VI (AND BELOW).[1]

1. a. Is it a sin to keep the change if the clerk gives you too much? ....
   b. Is it a sin to cheat? ....
2. a. What should you do if you saw a lady in front of you drop a five-dollar bill? ....
   b. How would you act if your mother told you to come home to go to the store and the boys wanted you to play ball?
3. a. What happens to a good little boy when he dies?
   b. Whom do you love best in all the world? .... Why? ....
4. a. Would it be wrong to take a nickel out of your mother's pocketbook without asking her? ....
   b. Would a lie be a lie if no one ever found out you told it? ....
5. What should you do if while playing in the parlor you broke one of your mother's best chairs? (No one saw you break it and your brother was blamed for doing it.) ....
6. What should you do if you had a bag of pop-corn and were eating it when a little child looked up at you hungrily? ....

ALTERNATIVE TEST.

1. a. Is it a sin to stay away from church on Sunday? ....
   b. Is it a sin to go bed without saying your prayers? ......
   c. Is it a sin not to say "grace" before meals? ....

[1] The small number of cases below year IX and above year XVII renders the standardization inadequate for these years. However further tests are being given for these ages and the results obtained will be used to aid in formulating more accurate norms. These results will be published in the near future.

YEARS VII AND VIII.

1. What should you do if your playmate broke your checker-board? . . . .
2. Why were you made? . . . .
3. a. Is it a sin to talk about someone you do not like? . . . . . .
   b. Is it a sin to throw snowballs when forbidden to do so? . .
4. a. What would you think if you heard a little boy say, "There is no God"? . . . .
   b. Who made you? . . . .
5. What should you do if a little boy or girl who never said any night prayers came to stay at your house for two or three nights, and got into bed before you have said your prayers? . . . .
6. A very poorly dressed woman, carrying a basket of apples was walking along the street. She looked as tho she were so tired she could hardly walk. Two pretty girls dressed up in their nicest dresses watched the woman as she passed them. "Isn't she ugly—and, oh, what an awful dress to wear," the one little girl said to the other, loud enough for the old lady to hear.

Do you like these little girls? . . . .
Why? . . . .

ALTERNATIVE TESTS.

1. a. Would it be wrong to say a swear-word when no one is around? . . . .
   b. Is it a sin to fight? . . . .
2. Robert is fourteen years old. His father died when he was only ten years old and his mother has been sick and not able to walk for a long time. After school Robert never stays out to play with the boys but hurries home to read to his mother and try to make her happy. The boys call him "big sissy."

Is it wrong or right for the boys to call him a "sissy"? . . . .
Why? . . . .

YEARS IX AND X.

1. Vocabulary (Catholic 12 words; Public 8 words)........
2. How should you act if your teacher scolded you for not having your lessons? ....
3. What should you do if a playmate hit you without meaning to do so?......................................
4. What should you do if your ball went through a neighbor's window? ....
5. The four boys had been playing hard all evening and were very hungry by nine o'clock, yet they did not care to go home. Jim proposed that they have a "lark." He was game, if the others would back him up to sneak around the corner of old Domico's fruit stand and roll out a watermelon. If they once got it they could run faster than the old Italian, so there was no danger of being caught.

Do you think this was a good thing for the little boys to do?...
Why? ....
6. Characteristic traits (8 correct) ....

YEARS XI AND XII.

1. Mamma and papa have told Mary who is eight years old that she must not lift baby John who is three, as he is too heavy, and she will hurt herself by doing it. One day while Mary and John were playing on the street in front of their house an automobile came along very fast. John ran out almost in front of it when Mary caught him in her arms and carried him to the sidewalk.

Was Mary disobedient? Answer YES or NO.............
Why? ....
2. Is it a sin to throw snowballs?........................
3. Interpretation of Picture No. 3........................
4. Characteristic traits (12 correct) ....
5. When Columbus came to America the Indians treated him very kindly. One little boy in the tribe who had, of course, never seen a white man before, or any man

dressed like Columbus was, loved him very much. Whenever Columbus passed near where he was the little boy would fall on his knees and cover his face, and pray to Columbus that it would not rain the next day for he wanted to go hunting. Who did the boy think Columbus was? ....

6. Vocabulary (Catholic 18 words; Public 10 words).......

Alternative Test.

1. Interpretation of Picture No. 6. ....

Years XIII and XIV.

1. Vocabulary (Catholic 21 words; Public 13 words)........
2. In our school is "silly Willie"
   Whom the kids tease all the time
   "Billy, Willie, you're so silly
   That to love you'd be a crime."

Is it wrong or right for the boys to sing a song like this?.....
Why? ....

3. Cross-out test (3 lines correct) ....
4. In most of our large cities there are theatres known as "Burlesque Shows." The main performances are open to men only. What is your opinion of this restriction?....

Years XV and XVI.

1. Vocabulary (Catholic 24 words; Public 22) ....
2. What should you do if your mother scolded you very hard? ....
3. Likeness and difference test (3 correct) ....
4. Interpretation of Picture No. 8. ....

Alternative Test.

1. Cross-out test (6 lines correct) ....

YEARS XVII AND XVIII.

1. Vocabulary (Catholic 35 words) ....
2. Likeness and difference test (8 correct) ....
3. Cross-out test (7 lines correct) ....
4. Suppose a boy in 1917, was certain that his father was pro-German and was going to inform the captain of a submarine the date of departure of a convoy. How should he act? ....
5. Is it a sin to talk in school? ....
6. Characteristics traits (16 correct) ....

ALTERNATIVE TEST.

1. Interpretation of Picture No. 5. ....

ADULT AGE.

1. Many people hold this theory for their philosophy of life: "I shall live my life in whatever way I may obtain the greatest possible happiness." Do you agree with this theory? ....

   Why? ....

   There is a young lady who married a man not for love but for material reasons. After she has been married a few years, there comes into her life a man who seemed destined to make her happy. As love for her "soul's mate" increases, life with her husband becomes more and more unbearable. Has this woman a right to rectify her earlier mistake and attain her life's happiness? ....

   Why? ....
2. Likeness and difference test (9 correct) ....
3. Interpretation of Picture No. 7...........................
4. Cross-out test (9 lines correct) ....

ALTERNATIVE TEST.

1. Interpretation of Picture No. 2. ....

SUPER-ADULT AGE.

1. Vocabulary (45 words) ....
2. Daddy had just come home with a nice big bundle under his arm. Ruth and Dick could hardly wait till he hung up his coat and hat, and opened the bundle. But at last the wait was over and kneeling beside daddy's chair they watched him break the string and take off the paper. Two new books were there. One had a beautiful elephant on the cover and the other was just plain. Ruth was older than Dick so daddy said she could pick which one she wanted.

If you were Ruth which one do you think you should pick?....
Why? ....

3. A gentleman through a very clever bit of business practice succeeded in legally swindling another man out of a considerable piece of property. It happens that the town grows around this property, and it becomes very valuable. After ten years have elapsed, the gentleman dies bequeathing the property to his grandson. In going over his grandfather's diary the young man discovers the entire record of the transaction. In the diary the grandfather stated that he knew he was really stealing the property. The heirs of the real owner are still living. Is the young man morally bound to restore all the property or its original value, or nothing at all?...........

Why? ....

4. A boy was adopted into a fairly wealthy family which consisted of a doctor, his wife, and their son. When the adopted son, who was somewhat older than the son, finished high school he desired to enter college. The doctor, through some reverses, had not sufficient funds to send him to college and also to provide for his own boy's education. Thus the adopted son, who was very noble-minded, insisted that the younger boy should have the preference. When this boy was sent to college he proved himself dissipated and a spendthrift. One day he demanded money from his father, and, on being refused,

flew into a passion and struck him. The blow caused him to reel backwards, and falling he struck his head against the sharp corner of a bookcase. Death was instantaneous. The adopted son who was just entering the room saw all that happened. The son realizing what he had done, and foreseeing the effect the news would have on his mother, begged his adopted brother to assume the guilt. In gratitude for the care and affection that he had received from his foster parents, and hoping to spare his foster mother the knowledge that her son was a murderer, he assumed the guilt.

Is he justified in his action? ....

Why? ....

5. Imagine the following situation:

A man and his young lady friend of city A went to a show in another city B, which is situated across the bay from city A. They spent the evening pleasantly but missed the last boat for B. The only way of getting home from B to A is by automobile a journey of six hours. If they went by automobile from B to A they would not arrive home any sooner than if they waited for the first boat in the morning. They do not know anyone in B. The young man has plenty of money with him, and there is a telephone connection. What should be done?.........

6. Interpretation of Picture No. 1. ....

Alternative Test.

1. In recent years it has frequently happened that white women have been attacked by negroes and greatly injured. The negro, on being arrested, has many times been seized by a mob and put to death. What moral right has the mob in such a case? Explain your answer fully............

2. Characteristic traits (20 correct) ....

Vocabulary (see p. 136)

Characteristic Traits

Draw a line under each word in the list below which indicates a trait of character you would like to possess.

gloomy	obedient	conceited	frank
humble	foolish	deceitful	flirt
aggressive	simple	lazy	patriotic
careless	thief	sincere	insulting
loving	polite	charitable	generous
shrewd	affected	vain	loyal
dissipated	neatness	liar	proud
friendly	insolent	extravagant	quarrelsome
modest	wicked	dishonest	patient
immoral	self-respecting	stubborn	cautious
sullen	pliable	peaceful	indecent
cheerful	impudent	sneak	honest

Cross-out Test

In each of the following lines cross out the word that is worst.

Example (1) begging, lying, smoking, murder, cheating

Example (2) dullness, foolishness, laziness, slowness, pity.

1. fighting borrowing charity killing dislike
2. dancing flirting obedience idolatry smoking
3. holiness cruelty kindness haste slang
4. frankness disloyalty shrewdness vanity bigamy
5. rudeness meekness gossip slander hesitancy
6. bullying insult black-mail tattling scolding
7. flattery lying fibbing frank insincere
8. love hate fondness dislike liking
9. courtesy pleasantness friendliness gentleness timidity
10. stinginess carefulness generosity charity economy

Likeness and Difference Test

In what way are these things alike:

(a) disobedience ....
stealing ....
(b) swearing ....
praying ....
(c) angel ....
baby ....
(d) God ....
your soul ....

In what way are these things different:

(e) saint ....
sinner ....
(f) God ....
man ....
(g) lying ....
cheating ....
(h) love ....
hate ....
(i) selfishness ....
gratitude ....

Procedure for Giving Individual Tests

Year VI (and below)

1. Procedure. Ask the child each of the following questions:
   a. *Is it a sin to keep the change if the clerk gives you too much?*
   b. *Is it a sin to cheat?*

Give the child ample time to answer one question before going on with the next. If the child answers any one of the questions automatically, ask: "Are you sure?" and record this answer as the correct one. The questions may be repeated but no other form used.

Scoring: The answer "Yes" is the only one which is given credit in these questions. No attention is paid to the exceptions the child may give to his general answer.

2. a. Procedure. Ask the child the question: *What should you do if you saw a lady in front of you drop a five-dollar bill?*

The question may be repeated but no supplementary questions may be asked.

Scoring: Any answer which shows that the child is aware of the moral obligation to help the woman find her money is considered correct. The most frequent form of answer given is "Pick it up and give it to her."

b. Procedure. Ask: *What should you do if your mother told you to come*

home to go to the store, and the boys wanted you to play ball (if a girl—*if the girls wanted you to jump rope*)?

This question may be repeated but no other form may be used.

Scoring: Any answer which shows that the child appreciates his obligation to obey is correct. Examples are "I would go to the store," "I would go home first and play ball afterwards." Such an answer as "I would not like it," or "I would be mad," are of course, not credited.

3. a. Procedure. Ask: *What happens to a good little boy when he dies?*

Scoring: The response: "He goes to heaven," "He goes to purgatory," are the only ones credited here.

b. Procedure. Ask: *Whom do you love best in all the world? Why?* This question may be repeated and if the child does not answer the "Why" he may be urged gently to do so.

Scoring: The answer "God" or "parents" (or those who stand in the place of parents as guardians), are accepted as correct for the first part of this question. In answering "Why" the child must give a reason for his love. Gratitude is most frequently given as the reason of this love. Duty is also a common reason. The child expresses this obligation to God in some such form as "He made me," "He loves me most," "He is my Savior," and to parents in "They keep me," "They do most for me," "I owe all I have to them."

Both parts of this question must be answered correctly in order that credit be given.

4. a. Procedure. Ask: *Would it be wrong to take a nickel out of your mother's pocket-book without asking her?*

Scoring: "Yes" is the only answer accepted with credit for this question. If the child suggests an exception such as "Not if you told her about it," it may be suggested "But you did not tell her" and the question repeated.

b. Procedure. Ask: *Would a lie be a lie if no one ever found out you told it?*

The question may be repeated.

Scoring: "Yes" is the only answer that receives credit in this question.

5. Procedure. Ask: *What should you do if while playing in the parlor you broke one of your mother's best chairs? (No one saw you break it, and your brother was blamed for doing it.)* No leading questions may be asked although the question may be repeated.

Scoring: Any answer which shows that the child recognizes the necessity of owning up to his own misdemeanor and saving his brother from being punished is counted correct.

A few correct answers are: "I would tell my mother I did it," "I would not let my brother get the blame," "I would tell the truth about it."

The answer "My brother would tell on me," or "I would let my brother get the licking" are, of course, wrong.

6. Procedure. Ask: *What should you do if you had a bag of pop-corn and were eating it when a little child looked up at you hungrily (very hungry)?*

"Very hungry" may be used in case the child has difficulty in understanding "hungrily." No other suggestions are allowed.

Scoring: Any response in which the subject expresses a feeling of sympathy for the hungry child and offers to share the pop-corn with him is credited. The most common response met to this question is, "I would give him some." "I would buy him some" was also given credit.

Alternative Tests.

1. Procedure. Ask each of the following questions:

a. *Is it a sin to stay away from church on Sunday?*

b. *Is it a sin to go to bed without saying your prayers?*

c. *Is it a sin not to say "grace" before meals?*

Scoring: Same as for Test 1. If the subject in answer to the question (a) answers "Not if you are sick," thus giving an exception instead of the general answer a reply on the part of the examiner such as "But we are not sick" will usually suffice to make the child answer in general terms.

Years VII and VIII

1. Procedure. Ask: *What should you do if your playmate broke your checker-board,* (if a girl—*if your playmate broke your doll*)*?*

Occasionally it is found that a child does not know what a checker-board is. In such a case the word "game" may be substituted. The question may be repeated if the child does not understand it on the first reading.

Scoring: Any answer which will make it known that the child feels obligated to forget himself and his displeasure and be kind to his companion is given credit. The answer "Buy another" was interpreted to mean this. "Forgive him if an accident, make him pay for it if on purpose" was credited, but merely "Make him pay for it" was counted wrong. The forms "Forgive him," "Forget it," Say nothing," and "Nothing" were all scored plus.

2. Procedure. Ask: *Why were you made?*

No explanation of the question is allowed, if the child does not understand.

Scoring: To be scored plus the subject must give a reason for his existence which will show he is conscious that he must be of service to his Maker or to his fellowmen. The ideal answer expresses a supernatural motive as, "To serve God," "To do God's holy will," or "To earn heaven." The altruistic sentiments "To help others," "To make the world better," "To lead a good life," and "To help my parents" are all counted correct. "Because my parents wanted me," or "Because my mother loves children" were given no credit.

The question was intended to bring out what the child hoped to do during life but its meaning, it will be seen from the answers quoted, was sometimes misunderstood.

3. Procedure. Ask the child each of the following questions:

a. *Is it a sin to talk about someone you do not like?*

b. *Is it a sin to throw snowballs when forbidden to do so?*

Scoring: "Yes" is the only correct answer which receives credit. The questions may be repeated.

4. a. Procedure. Ask: *What would you think if you heard a boy say "There is no God"?*

The question may be repeated in case the child does not understand.

Scoring: Any response which proves that the child does not agree with the principle suggested is given credit. Some forms of replies frequently given are: "I would think he did not know what he was talking about," "I would think he never went to Sunday-school," etc.

b. Procedure. Ask: *Who made you?* If the child does not understand the question it may be repeated.

Scoring: Two forms of correct answers have been accepted to this question. The child may name his creator, God, or his procreators, his parents. No other answer is given any credit.

5. Procedure. Ask: *What should you do if a little boy or girl who never said any night prayers came to stay at your house for two or three nights, and got into bed before you have said your prayers?*

If the child does not understand the question at the first reading it may be repeated.

Scoring: An answer which shows that the child will say his prayers and not heed the suggestion given in the conduct of his companion is sufficient that the answer may be credited. It is not necessary that the child assume any responsibility for his companion's act, although, of course, the assumption of such responsibility would not be counted wrong.

Answers such as "I would say my prayers," or "I would pretend I did not notice and say mine," are typical. Such an answer as "I would ask him to say his," or "I would make him get out and say them" is also given full credit.

6. Procedure. Read aloud the story *A very poorly dressed woman, etc.* (Only one reading allowed.)

Scoring: The answer to the first question must be "No." The answer to the "Why" must show that the child has a knowledge of the duty of charity to his neighbor, or of respect for his elders, or an appreciation of the undesirable qualities which the little girls have shown themselves to possess by their speech.

"They made fun of the lady," "She was poor and could not help her looks," "They did not help carry the basket," "They show no respect for older people because they said that," "They are rude, unkind, proud, etc." are examples of answers scored plus. Such an answer as "One, because she did not say anything," or "Yes, they are dressed nice" are examples of incorrect answers.

Alternative Tests.

1. a. Procedure. Ask: *Would it be wrong to say a swear-word when no one is around?*

This question may be repeated.

Scoring: The answer "Yes" is the only acceptable one to this question.

b. Procedure. Ask: *Is it a sin to fight?*

Scoring: At this age more than 75 per cent of the children consider that it is a sin to fight. The answer "Yes" is the one scored plus.

2. Procedure. Read story *Robert and his mother,* etc. (Only one reading allowed.)

Scoring: The child must answer that it is "wrong" to call Robert a "sissy." If the child merely answers "Yes" to the question, it, the question,

may be repeated. In answering the "Why." the reason must bring out the concept that "It is uncharitable," or "That the boy is doing this for love of his mother," "He is making his mother happy," "His mother is sick and needs him," "They may make Robert quit helping his mother," "It is not fair, he is not a 'sissy'" are scored as correct. An answer "Wrong because it is not nice" or "not right" was given no credit.

Procedure for Giving the Group Tests

The tests as standardized for Years 9, 10, and 11 are based on both Individual and Group Tests. The results in the two cases were found to differ so little that the combination was made possible. Exactly the same wording was used in the Individual Tests for these years as was used in the printed blank. The instructions also were the same. The only difference was that in the one case the subject read the tests for himself and wrote his answer; in the other the tests were read to him and he gave the answer orally. All the tests beyond the age of 11 are standardized as Group Tests only.

Each child is given a blank which he is asked not to open until the signal is given. The following explanation of the tests is then made.

"You have on the desk before you, boys and girls, a blank which when you open and read, you will find contains a number of questions and stories. I know you will find them interesting. In order to answer these questions you must think seriously. Unless you answer the questions frankly and honestly your paper is worthless and it would be better for you not to waste time writing it. You will find in the blank some questions you cannot answer and some that are very easy. You are not supposed to be able to answer all the questions so as soon as you have read a question over and are sure you cannot answer it, simply put down 'I do not know,' and do not waste time on it.

"You will find that a number of questions ask, 'What should you do?' in certain cases. Notice the word 'should' and answer what you think you should do to these questions.

"You will take pencils, please. We will fill out the first page of the blank together." The examiner then goes over the details of the face sheet, telling the class just what to put down.

"Now open to the next page. Begin with the first question and answer each question as quickly and as carefully as possible."

The class is then permitted to go on with the questions until they reach the Cross-out Test where they are asked to do the examples at the beginning of the test in common. Special instructions are given again when they come to the pictures. At that point it is necessary to point out that even though there may be two or three pictures on it, each card represents a single theme. It is also necessary to emphasize what is desired, *i.e.*, they are to explain what the picture means, what story the picture tells, or what the picture is about.

The scoring of the tests included in this standardization may be found in detail in Chapters IV, V, and VI.

CHAPTER XI

Correlation of the Results with those of other Observers

A study such as the one we have just reviewed investigates the moral sense of the child in so far as he is able and willing to reveal it through direct and suggestive questioning. The seriousness with which the children went about their task justifies the conclusion that the child has revealed his real moral convictions and ideals. Sometimes his standards are wrong when we judge of them by adult values; more often they are merely immature. The standards one has do not, of course, insure his living up to them on all occasions but they do presuppose that he will do so in the majority of cases or, in spite of himself, he will experience a lowering of them.

Moral ideas, considered objectively, are those ideas which are made necessary by the conventions regulating the relationship of man to man in adult society.

In the course of his intellectual development the child gradually becomes aware through the medium of experience of what these ideas are. We have attempted to study definitely through the most direct means at our command, the time and order with which the child appreciates these moral concepts.

In the "History of the Problem" a brief review was attempted of the works related to our subject. We shall attempt now a comparison of the moral concepts and ideals appearing in these studies and the same concepts and ideals appearing in the present study.

G. Stanley Hall[1] points out that "the normal child feels the heroism of the unaccountable instinct of self-sacrifice far earlier and more keenly than it can appreciate the sublimity of truth." This is exemplified in Story No. 15 (p. 51) where even at the age

[1] Hall, G. Stanley, "Children's Lies," American Journal of Psychology, p. 61.

of 18 the percentage approving the sacrifice of the foster-son is larger than the percentage recognizing the lie. A sense of justice, however, appears earlier than either self-sacrifice or the appreciation of truth.

Dr. Hall[2] found evidence further, that "lies are justified in the minds of children as means to noble ends." Saving the foster-mother's life is the noble end which justifies this action in the minds of most children in Story No. 15. A better example of this principle is given in Story No. 11 (p. 43). The child has in this case, as he sees it, a choice between telling the truth, and keeping a promise. To keep the promise is considered the better thing to do at the younger ages.

Another instance of agreement with Dr. Hall's tests is found in Story No. 9. In answer to a friend's question if some thing or act they did not particularly admire, was not very nice or pretty, Dr. Hall's subjects found it hard to say "No" and compromised on "Kind of nice."[3] Girls were more prone to this than boys. A question of personal interest with girls is how far etiquette may stretch truth to avoid rudeness or "hurting others' feelings." Most children admitted in Story No. 9 that their response would be dependent to some extent on how well they knew the person. An ordinary acquaintance would be flattered, while frankness would be the attitude assumed toward a friend.

We find that when the child is given a very specific and definite situation involving truth he recognizes his obligation at an early age. The only exception to this in the question, *What should you do if while playing in the parlor you broke one of your mother's best chairs? (No one saw you break it and your brother was blamed for doing it.)*, was found where the children showed signs of fear. Judge Lindsey says[4] "the most demoralizing agency in childhood is fear, and it may be found at the bottom of the most of the immorality among children." It is also pointed out in this article that the child's idea of "why" an act is wrong is malformed.

[2] G. Stanley Hall, "Children's Lies," American Journal of Psychology, p. 60.
[3] *Ibid.*, p. 62.
[4] Lindsey, Ben B. "Childhood and Morality," Jour. of Proc. N. E. A. 1909. p. 148.

Often it is not because an act is contrary to some law, but because "He will get caught" that the delinquent decides to reform. It hardly seems possible that this is the case with the ordinary child. In fact, in Story No. 7, (p. 35), only a small number of cases consider the act of stealing wrong, because "They may get caught," or because, "The cops will take them." The great majority of children point out definitely the fact that the boys are stealing, as the percentages in the Table for this story show.

Judge Lindsey outlines the most common offenses against morality among school children as follows: "Disobedience, swearing, use of tobacco, lying, stealing, and personal impurity in thought and action." A comparative schema of these faults is given below. This has been compiled from Tables recording the results to the question, *Name three things it is bad-to-do* for the Individual Tests,[5] the Catholic School Tests,[6] the G. Public School Tests,[7] and the P. Public School Tests.[8] The order used in the schema was obtained for each school separately by ranking the faults according to the highest percentage attained at any of the years tested. There is recorded in the schema also the rank these faults have been given by teachers after one month's observation in their classroom, and the rank they have been given by children when a list of faults was presented to them to be arranged in the order in which they thought they committed them most frequently.[9]

	Disobedience	Swearing	Use of Tobacco	Lying	Stealing	Personal Impurity
Judge Lindsey	1	2	3	4	5	6
Bad-to-do						
Individual Tests	1	4	5	2	3	6
Catholic	4	3	6	2	1	5
G. Public	4	2	6	3	1	5
P. Public	4	2	6	3	1	5
Rank by Children	1	3	..	2	3	..
Rank by Teachers	1	4	..	2	3	..

The list of juvenile offenses given by Judge Lindsey has been

[5] See Table 94.
[6] See Table 95.
[7] See Table 99.
[8] See Table 98.
[9] See p. 141.

found to correlate with the list as ranked in the schema above for the different schools as follows:

Judge Lindsey's list of faults with that of the teachers	40
" " " " " " Catholic Schools	—14
" " " " " " Individual Tests	54
" " " " " " P. Public and G. Public Schools	—03

The records of class-room observation submitted by the teachers do not mention either impurity or smoking as faults of their children. Neither of these faults were in the list presented to the children to rank, and therefore, no comparison of their value as related to that of Judge Lindsey is possible. The faults mentioned in common by the Judge, the teachers, and the pupils, namely: disobedience, swearing, lying, and stealing have been found to correlate as follows:

Judge Lindsey's list of faults with that of the teachers	40
" " " " " " " " " pupils	70

F. W. Osborne[10] states that "the two virtues most frequently mentioned as essential to the good boy or the good girl are obedience and truthfulness; the former, however, seems to be more important that the latter." That obedience is the virtue *par excellence* of children even during the period of adolescence, is verified by several tests reviewed in this study. Truthfulness as a general trait of character does not appear until much later, and in our Tables for acts *good-to-do*[11] is surpassed by other character traits.

Irving King holds from the results of his study which is a summary and criticism of empirical works on Child Study, that boys' moral ideals at ten are negative rather than positive; *i.e.*, the fragments of adult morality that they have imbibed are of this sort. For instance, they wish to avoid bad habits—a prob-

[10] Osborne, F. W., "The Ethical Contents of Children's Minds," Educational Review, VIII, 1894, p. 145.

[11] See Tables 86-93.

able reflection of much of their moral teachings. Girls, on the other hand, express as their highest desire that of being good to others.[12] We may assume, surely, that one's *highest desire* and his idea of the *best action one can do during life* should correlate high. Our Tables show, however, that boys at 10 have positive ideals on religion, obedience, charity, and honor; and in practically all cases for the different School Systems considered, they give larger percentages for these *best actions* than do the girls. In fact, negative virtues receive practically no mention at this age for boys either in answer to this question, or in answer to the question, *Name three things it is good to do.*

Mr. King notes also in his work[13] that "in studies of children's aspirations altruistic feelings definitely appear at 12, and naturally first with the parents." We do not find so definite an appearance of these feelings. In Story No. 14,[14] we find that boys show a great increase in altruistic feelings at 11, girls at 12. The answers to the question *Why were you made?* show that children (unless they misunderstand the question altogether) have an altruistic concept of their purpose in life at an age much younger than 12. We find no evidence, moreover, in the regular increase and decrease of percentages at 12 in our Tables, that pre-adolescence is a marked time of susceptibility to influence of others, an indication of the coming to consciousness of social relationships; or that the age of 12 has been found to be of greatest susceptibility to evil influence—an evidence of the beginning of that imperious attitude toward restraint that is so prominent in the next few years.[15]

We do find that by the age of 12 children have developed considerable moral consciousness—but there is no evidence of a "sudden awakening" of moral qualities. Growth is accelerated a little before 12 and continues after this age but it is not so rapid as to be remarkable.

[12] King, Irving, "The Psychology of Child Development," p. 207.
[13] *Ibid.*, p. 202.
[14] See p. 52, Table No. 19, II.
[15] King, Irving, "The Psychology of Child Development," p. 193.

Dr. Kline[16] in his study of Juvenile Ethics found as we do, that "the higher percentages of altruism are not confined to adolescent years." He states also that "children from 8-18 are altruistic rather than selfish."[17] Our results show that this second statement holds true in certain situations, but not in others. Children are in general kind, polite, charitable, and honest in their dealings with others but they are selfish as to personal gain and in satisfying their own wants first. Children become conscious just before the onset of adolescence that "the ethical ideal of life is not to be found in pleasure but in duty,"[18] but long before this time they are conscious that certain specific altruistic traits are desirable.

The morality of the young child assumes the concrete form of habits; abstract principles are still beyond its grasp. This principle expresses a concept which should be basic in all educational work, especially in moral educaton. We are no less creatures of habit morally than we are physically. We learn a complex physical feat by continual practice of the separate acts of which it is composed until they have become habitual; we grasp complex moral principles through familiarity and practice of concrete moral acts, until they have become habitual and are amalgamated into a composite whole. We desire our children to be developed morally. The only way to accomplish this end is to train the child from infancy in the performance of specific moral acts. This training must go on at all times and at all places to be effective. Very few things we do, viewed subjectively, are unmoral because they tend to character formation. We should, therefore, train children to see the moral significance of their acts and to perform them always from the highest possible motives. In order to carry out this indirect method of teaching morals effectively, the direct method should also be used. Suggestion will prove the secret that will arouse the child's interest

[16] Kline, L. W., "A Study in Juvenile Ethics," Pedagogical Seminary, 1903, p. 246.

[17] *Ibid.*, p. 265.

[18] Moore, T. V., "A Historical Introduction to Ethics," p. 149.

and make him desire knowledge of this nature. If the periods of his natural interest in problems, as they have shown themselves to appear and disappear in this study, are followed, and if the course of study is made concrete and practical, the maximum of interest must be aroused. The earnestness displayed by the children in writing the paper which formed the basis of this study, reveals the interest they have in the vital things of life and to what extent they will exert their minds to solve real problems if only they are given the opportunity. While we agree unreservedly with Miss Harrison[19] when she says "the inalienable right of every child is the right to be corrected for unsocial conduct," we would follow the idea a step further and say that it is the inalienable right of every child to be trained to social conduct before he has the chance to err. Moral education should be primarily formative, not corrective.

[19] Harrison, E., "When Children Err," p. 29.

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TABLE OF CONTENTS

THE HAIR FOLLICLE AND THE SENSE OF PRESSURE

BY

R. H. Stetson

It has been assumed that the end-organs for pressure are located at separate points, like those of warmth and cold. Careful exploration of the skin by Goldscheider and v. Frey[1] revealed separate spots where the sense of pressure reaches a maximum. The intervening skin is also sensitive to pressure, but that may be the result of the transmission of the stimulus through yielding skin structures to the nearest 'pressure spots.' The actual end-organs for warm and cold are in doubt, but it has seemed easy to determine the end-organs for pressure. On hairy areas maximum sensitiveness to pressure occurs at a spot to the 'windward' of the hair, and is evidently due to the stimulation of the hair follicle. The follicle lies embedded in the skin at an angle so that the 'pressure spot' occurs over the follicle a millimeter or so from the point where the hair emerges. It is easy to see the relation, for stimulation of the 'pressure spot' moves the hair shaft.

The histology of the hair follicle reveals an elaborate innervation which might well mediate an important cutaneous quality. A double innervation has been described and is a commonplace in the text books.[2] A detailed account of the innervations of the follicle with references to the original studies and with drawings of the structures is given by Prenant and Bouin.[3] They speak of the neural ring of non-medullated fibres which originate from a nerve entering the follicle at the level of the opening of the

[1] A. Goldscheider, Ges. Abhandl. I, 1898. v. Frey, Vorles. u. Physiol. 1894. v. Frey, Ergebnisse d. Physiol. (Asher u. Spiro) 1913. Bd. 13, S. 96. Physiol. d. Sinnesorgane d. mench. Haut. II, Der Drucksinn.

[2] Stewart, Manual of Physiol., 1910; Howell, Physiol., 1896, p. 260; Bailey, Histol., 1910, p. 365; Ferguson, Hor. Histol., 1905, p. 225; Piersol, Nor. Histol., 1910, p. 328.

[3] Prenant et Bouin, Traité d'Histologie, 1911, p. 624 ff.

sebaceous glands. This neural ring is double and lies well outside the vitreous membrane. On the outside surface of the vitreous membrane at the level of the neural ring and extending below it are a number of enlarged, spatulate endings, possibly derived from the fibrils of the ring. There is also an innervation of the root proper of the hair, nerve fibres which enter the papilla of the follicle at the lower end of the follicle. Szymonowicz[4] has made a detailed study of the innervation of the human hair by the methylen blue method, and has been able to reconcile the statements of previous authors. He speaks of the neural ring and the flattened endings on the outside of the vitreous membrane just below the sebaceous glands, and of the nerve entering the papilla of the hair. His detailed drawings give an idea of the form of the nerve endings and of their distribution. The material used was freshly excised from the eyelid and from the lower lip. The studies of the human hair follicle have been confined to a few localities on the human body.

The tactile hairs of many mammals are undoubtedly important touch organs, and have been studied. Their innervation is not unlike that of the human hair; this increases the probability that the human hair is an important tactile organ.[5]

Actual experiment shows that the hair itself is an important factor in the pressure sense. Vincent quotes Sherrington: "On 9 sq. cm. of skin from which the hairs have been shaved, the liminal stimulus was found to be 36 mgm, whereas, on the same surface before it was shaved, 2 mgm was the liminal stimulus." And it is well known that the hair itself is more sensitive to pressure than the 'pressure spot' near the hair.

Following v. Frey, Thumberg[6] and others speak of the hair acting "as a lever, in that the neural stimulation may be described as a moment of rotation wherein the surface of the skin acts as

[4] L. Szymonowicz, Ub. die Nervenendigungen in d. Haaren d. Menchen, Archiv. f. mikro. Anat. 1909, Bd. 74, S. 622-634.

[5] S. B. Vincent, The tactile hairs cf the white rat, J. Comp. Neurol. v. 23, 1913, p. 1-38. J. E. Eckert, The innervation of the integument of Chiroptera, J. of Morphol., 1914, v. 25, p. 315-320.

[6] Nagel's Handb. III, 1905, S. 664.

a fulcrum." This notion of the hair as a lever of the first class in which the epidermis at the point of emergence acts as a fulcrum so that the movement is transmitted to the follicle has been commonly accepted. It is apparent that the skin does act as a fulcrum for the tactile hairs of animals when they are moved, and something like that must take place when the human hair is erected by the muscles of the hair follicles. Nevertheless the observation is inaccurate when applied to the human hair as a tactile organ.

Despite this general acceptance of the hair follicle as the pressure organ in hairy areas, there are certain acts not in accord. It is hard to understand why the scalp and the bearded area of the face should not be far more sensitive, if they are crowded with pressure organs. Moreover the 'pressure spots' unlike the warm and cold spots, are but points of maximum sensitiveness, and the skin is everywhere sensitive to pressure. Murray[7] speaks of the difficulty of a precise localization of the 'pressure spots,' and of the apparent existence in the intermediate areas of other spots of approximately equal sensitiveness, and of the impossibility of reproducing the granular sensation by electrical stimulation of the verified spots. The extreme delicacy of the response when the skin is lightly touched with cotton, etc. makes it doubtful if there is transmission to such deep-lying structures as the follicles. Merkel[8] hazarded the guess that certain simple end-organs scattered in the skin as well as about the hair follicles were "touch corpuscles." And certainly Murray's statement: "The greater efficiency of pressure over the hair bulb in the production of the pressure sensation is probably due to the mechanical effect through the grinding down of the comparatively solid follicle upon the underlying endings" is worth noting. There is good reason to consider his assertion that "the so-called granular pressure is not in itself an element but is a complex of deeper pressure with contact. . . ."[9]

[7] E. Murray, Qual. Anal. of Tickle, Am. J. Psy. 1908, v. 19 (3), p. 299.

[8] F. R. Merkel, Tastzellen in Tastkörperchen bei d. Hausthieren u. b. Menchen, Archiv f. mikro Anat. 1876, Bd. 11, S. 647.

[9] Murray, *ibid.*

PROBLEM

It is possible to investigate the function of the hair follicle as an end-organ for the sense of pressure by two methods:

1) The neural endings of the follicle may be removed, and the effect on the sensitiveness of the hair itself and of the adjacent areas studied;

2) The pressure sensitivity of areas denuded of follicles may be investigated.

Before operating the hair follicle, preliminary studies of the movements of the follicle and the resulting sensations were made. The skin, carefully scrubbed and softened, was moistened with a little water and glycerin, and examined with a Zeiss binocular erecting microscope magnifying c.9 times. A strong red light was used for illuminating; unlike the white light the red light is not reflected, rendering the surface opaque, and it penetrates the skin to a slight depth. By this means the hair-shaft of a dark-haired subject may be traced about two millimeters into the skin, and the movement of the follicle noted when stimulation is applied.

On moving the hair on back of hand or on forearm, under such conditions, it is easy to see that the description of the hair as a lever of the first class is inaccurate. The lower end of the follicle is far more firmly fixed than the surface where the hair emerges, and the movement affects the lower end little if at all, while the upper part of the follicle and the skin at the point of emergence undergo considerable deformation. The hair is a lever of the second class, with the fulcrum at the lower end of the follicle, rather than a lever of the first class with the fulcrum at the surface where the hair emerges. The hair is like a willow shoot deeply rooted in light sand; when the shoot is moved, the part just below the surface, and the surface layer of the sand itself are stirred, but the root of the willow shoot is not moved.

For a careful study of the movements of the follicle including the papilla, the hairs of the scrotum were used; the skin is thin and transparent, the follicles large and single, and the papilla clearly defined by a pigmented spot. On the scrotum as else-

where, the movement of the skin about the point where the hair emerges is a most striking item in the stimulation of the hair. The skin may be fixed with collodion, and the lower end of the follicle moved two millimeters without causing sensation. This was verified by repeated observations on several hairs on each of three subjects, two of whom were trained observers.

When traction is exerted on the hair it is easy to see that the lower part of the follicle is not the significant point; the end of the follicle may be moved back and forth two or three millimeters without the sensation of pulling being noted. On the other hand, if the skin is fixated by putting a blunt point, or a hook partly encircling the hair, into the pit of the hair, a slight traction is quickly perceived; much greater traction must be exerted if the skin is not fixated. This indicates that the pressure sensations are mediated by the upper part of the follicle, and possibly by the skin surface at the point of emergence. These observations were verified on several hairs on each of five subjects, two of whom were trained observers.

OPERATION ON THE HAIR FOLLICLE

Removal of the lower part of the Follicle.[10]

The area selected for the operation was the anterior portion of the scrotum near the median line. The surface is fairly sensitive to pressure, and the localization is about as good as on the fore-arm. The follicles are easily seen and operated. They are single and widely separated, as in no other part of the body. A strong red light was used, and the work was done under the binocular with a magnification of c. 9 times. To fixate the follicle, a No. 14 or 16 needle (f.n. in Fig. 1) in which a minute bend had been made was passed through the skin, under the follicle at right angles, and out on the other side, pinning the follicle in a tiny stitch in the skin (Figs. 1 and 2). The follicle lay in the bend of the needle (Fig. 2). Without local anesthesia, a transverse in-

[10] Mr. C. C. W. Nicol, Assistant in the Oberlin Laboratory 1912-13, assisted in the development of a rather difficult and exacting technic, and did a part of the tedious work of operating and testing the hair follicles.

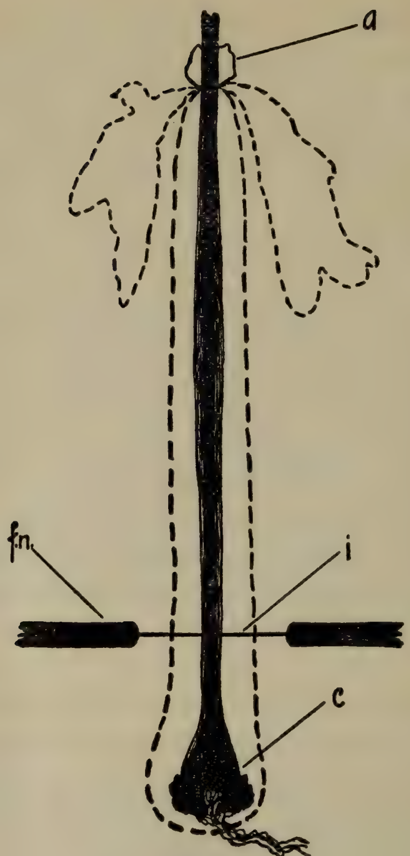


Fig. 1

cision was made just over the needle (i in Figs. 1 and 3) with a small scalpel ground out of a needle; then the papilla (c, in Fig. 3) with about half a millimeter of the follicle was snipped off (at d in Fig. 3) with scissors ground to fine slim points. The severed portion was removed with fine tweezers. It is unnecessary to snip off the lower part of the follicle; dissecting it loose breaks all connections; but for the sake of certainty the lower part of the follicle was always removed. The operations were done with the usual precautions, without local anesthesia. The tissues are resistent to infection and the wounds heal very rapidly. There

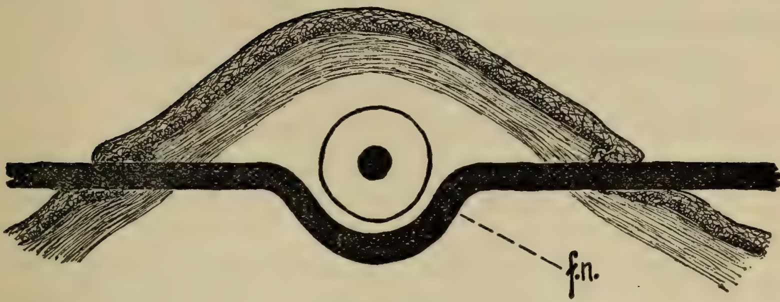


Fig 2

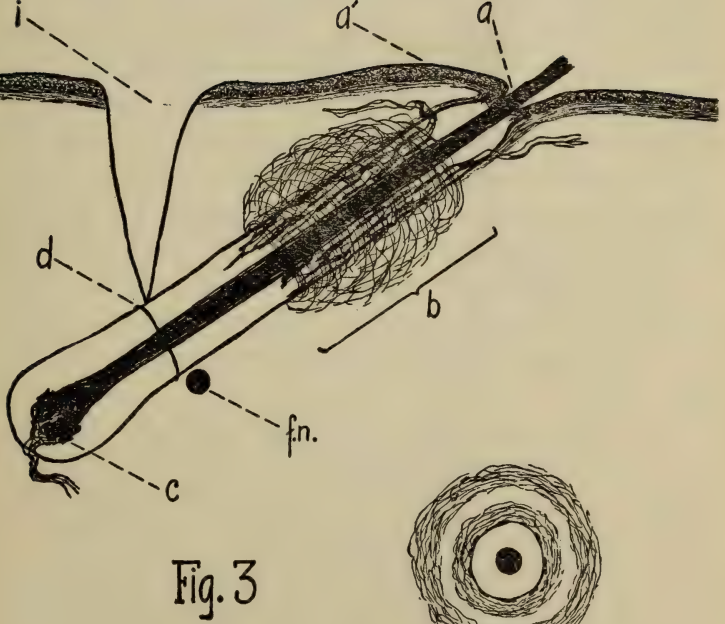


Fig. 3

cross-section at "b"

was a slight induration about the scar, but the reaction had disappeared, and the wounds were practically healed in two days.

Lower part of the follicle removed, on scrotum: when tested the stimulus was applied to the hair.

St.	3	follicles	operated,	tested	48	hrs.	later			
	2	“	“	“	“	“	“			
L.	5	“	“	“	“	“	“	Follicles	in a	group
	7	“	“	“	“	“	“	“	“	“
N.	6	“	“	“	“	“	“	“	“	“
	7	“	“	“	“	“	“	“	“	“
S.	8	“	“	“	“	“	“	“	“	“
	1	“	“	“	“	“	“	“	“	“
Ni.	8	“	“	“	“	“	“	“	“	“
	1									
	—									
	48									

In every case every hair was sensitive after the operation, and there was no difference in quality or localization whereby the operated hairs could be distinguished from the neighboring normal hairs by any of the subjects, two of whom were trained observers. Care was taken, of course, in applying the stimulus to the hair shaft, not to touch the skin or other hairs; if necessary the microscope was used in stimulating and observing the hairs.

When tested with the v. Frey esthesiometer, in all cases the skin about the point of emergence and between the operated hairs was as sensitive as the neighboring normal areas. The sensitiveness was somewhat reduced on the ‘pressure spots’ as they were near slightly indurated scars. (E.g. readings for normal ‘pressure spots’ 14-15, for intermediate areas 16-18, for indurated scars 20-23.)

The v.Frey esthesiometer used throughout the tests was furnished with a ‘hair’ made by reducing a steel hair-spring in a bath of dilute nitric acid. A tip was made by inserting the hair-spring in flame and producing a globule of oxid, or by attaching a globule of hard cement; the oxid or cement is ground down on a fine carborundum hone to the proper dimensions. Such a ‘hair’ does not lose its elasticity, is very uniform throughout its length, and is not affected by moisture.

As to the precise sensitiveness of the operated hairs, it was the

judgment of both experimenters that the operated hairs were slightly less sensitive than the normal hairs; the subjects could make no such discrimination. It is of course difficult to get any quantitative tests for stimulation of a hair, and nothing could be based on this judgment. A slight reduction of sensitiveness might well be expected from the disturbance and from the slight induration which limited the movement of the follicle and of the skin.

Whether the papilla is removed, or merely dissected loose, the hair falls out in a week or so; but it remains in place long enough for tests. The time (two days) between operation and test is of course much too short for any regeneration of the nerve fibrils.

Removal of the Upper Part of the Follicle

It is agreed that the nerve supplying the elaborate innervation of the upper part of the follicle enters at the level of the opening of the sebaceous glands, and that the neural ring and the flattened endings are just below the glands. The sebaceous glands are easily seen on the scrotum. It is possible to remove the upper part of the follicle so as certainly to eliminate the upper innervation of the follicle.

The follicle was fixated by pinning it transversely into a tiny stitch in the skin (Fig. 1); the follicle lies in a minute bend of the needle (Fig. 2). A transverse incision (i, Fig. 1 and 3) is made in the skin just above the needle. The upper part of the follicle is carefully dissected from the skin by inserting beneath the skin a spade-shaped blade with rounded end; then with a hook-shaped blade sharp on both inner and outer curves, the upper part of the follicle is freed at the sides and beneath, down to the level of the fixating needle (f. n., Fig. 3). Care is taken not to pierce the skin. With a pair of special tweezers the tough, elastic vitreous membrane is stripped off the hair, beginning at the level of the fixating needle (f.n., Fig. 3) and working under the skin until the follicle has been stripped out to the point of emergence. The hair shaft is left in place.

The knives were ground from No. 5 needles. The tweezers were made of two "crow-quill" steel pens carefully ground until the points are very slender. The four minute strips of steel were then bent at the tips until slightly hooked and ground sharp at the squared tips. These four prongs encircle the hair and strip away the follicle, but are elastic enough not to tear the hair.

In this fashion the follicle is cleared away for about one-half its length; care is taken not to disturb the lower end of the follicle. The transverse incision is 1.5-3 mm. from the emergence point and the skin about the hair is intact. The reaction subsides in a day or so and the wound heals in a very short time, leaving the hair uninjured—unlike the first operation.

Removal of the upper part of the follicle on scrotum; when tested the stimulus was applied to the hair.

St.	1	follicles;	tested	after	48	hrs.	Sensation	nearly normal
	1	"	"	"	48	"	"	decidedly subnormal
Ni.	3	"	"	"	12	"	"	normal; after 48 hrs. normal
St.	4	"	"	"	12	"	"	normal
P.	1	"	"	"	12	"	"	normal
M.	3	"	"	"	12	"	"	normal
	1	"	"	"	12	"	"	decidedly subnormal; after 48 hrs. c. normal
K.	5	"	"	"	12	"	"	normal; after 48 hrs. normal. Follicles in a group.
Ma.	5	"	"	"	12	"	"	normal; after 48 hrs. normal. Follicles in a group.
M.	4	"	"	"	12	"	"	normal
St.	4	"	"	"	48	"	"	normal. These hairs were compared with normal hairs which had been scarified without injuring the follicle; no difference found.
K.	4	"	"	"	12	"	"	normal; after 4 days, normal.
Ni.	3	"	"	"	12	"	"	normal
	1	"	"	"	12	"	"	slightly subnormal
L.	1	"	"	"	12	"	"	decidedly subnormal
	1	"	"	"	12	"	"	slightly subnormal
Ni.	2	"	"	"	24	"	"	slightly subnormal
K.	4	"	"	"	12	"	"	subnormal; 4 days after, subnormal.

S.	1	"	"	"	48	"	"	normal
	1	"	"	"	48	"	"	decidedly abnormal; scar tissue.
L.	1	"	"	"	24	"	"	normal
	1	"	"	"	24	"	"	slightly abnormal
T.	2	"	"	"	24	"	"	subnormal; 48 hrs. after, normal
Ma.	2	"	"	"	24	"	"	normal
K.	1	"	"	"	24	"	"	decidedly subnormal; 3 days after, slightly subnormal.
	1	"	"	"	72	"	"	normal
S.	3	"	"	"	24	"	"	sensation subnormal; 48 hrs. after, slightly subnormal.
L.	1	"	"	"	48	"	"	slightly subnormal
Ma.	1	"	"	"	48	"	"	slightly subnormal

63 hairs operated on eight subjects.

Of these 63 follicles, 4 proved to be decidedly subnormal, though not insensitive; it is possible that in those cases the nerves of the skin were severed, or the formation of scar tissue involved the fibers supplying the skin about the hair.

From these results it is easily seen that there is a tendency to reduction of the sensitiveness of the hair when the upper innervation of the follicle is removed. In many cases this is not apparent on scrotal areas but it comes out more plainly on other parts of the body.

The lower arm has been much used for study of skin sensations. It is not entirely satisfactory for the present purpose, because it is difficult to find single hairs. On nearly all parts of the body the hairs are closely set in threes, one large hair with a small guard-hair on either side.

Removal of upper half of follicle on lower arm; when tested the stimulus was applied to the hair.

St.	2	follicles;	tested	after	24 hrs.	Subnormal: 2 days after, subnormal.
	2	"	"	"	48 "	Subnormal
Tu.	2	"	"	"	48 "	Subnormal
M.	1	"	"	"	6 days	Subnormal

Removal of the upper half on upper leg, just above patella; when tested the stimulus was applied to the hair.

St.	2	follicles;	tested	after	24 hrs.	Subnormal; 6 days after nearly normal.
	2	"	"	"	24 "	Subnormal; 4 days after nearly normal.

Removal of upper half of follicle on lower leg; when tested the stimulus was applied to the hair.

L.	4	follicles;	tested	after	48 hrs.	Subnormal
	2	"	"	"	4 days	Subnormal
M.	3	"	"	"	48 hrs.	Subnormal
	2	"	"	"	48 "	Subnormal

The point of the hip, just outside the area of pubic hair is a good locality for testing hair follicles; the hairs are large, sparse, and single.

Upper half of the follicle removed on point of hip; when tested the stimulus was applied to the hair.

St.	6	follicles:	tested	after	6 days,	Subnormal
M.	2	"	"	"	4 "	Subnormal
	3	"	"	"	2 "	Nearly normal
Ni.	3	"	"	"	2 "	Subnormal
	4	"	"	"	4 "	Slightly subnormal
L.	2	"	"	"	4 "	Subnormal
	2	"	"	"	4 "	Nearly normal
N.	4	"	"	"	12 hrs.	Subnormal
Sh.	5	"	"	"	11 days	Subnormal
L.	1	"	"	"	6 "	Subnormal
M.	1	"	"	"	2 "	Subnormal
	1	"	"	"	2 "	Almost normal

(The interval between operating and testing was lengthened because more time was needed for healing.)

In all these cases the removal of the upper part of the follicle, the quality of the hair sensation is not changed; the subjects are unable to discriminate between the operated hairs and the neighboring hairs. It is evident however that there is a decided reduction of the sensitiveness of the hairs operated on other parts than the scrotum. That this does not occur more often on the scrotum is probably due to the greater size and rigidity of the hair, and the greater mobility of the surface, whereby the movement of the hair-shaft produces a decided deformation of the skin.

Removal of both Upper and Lower Innervations of the Follicle

Although the preliminary experiments, and the removal of the lower end of the follicle indicate that the lower innervation of

the follicle has no influence on the pressure sensation, it is possible to argue that the pressure sensation remaining after the removal of the upper half of the follicle is not due to the deformation of the skin about the hair, but to the stimulation of the lower innervation. To test this, a number of hairs were subjected to both operations. The upper part of the follicle was removed, the wound allowed to heal, and then the lower part of the follicle was exsected. The hair was then little more than a bristle set in a mass of scar tissue.

Removal of upper and lower innervations of follicle on scrotum; when tested the stimulus was applied to the hair.

M.	2	follicles;	tested	24 hrs.	after	2d	operation.	Probably slightly subnormal.
	4	"	"	24 "	"	"	"	Probably slightly subnormal.
				3 days	"	"	"	Normal
W.	3	"	"	24 hrs.	"	"	"	Slightly subnormal
	4	"	"	24 "	"	"	"	Slightly subnormal

On stimulating such hairs, the sensation must come of course from the skin at the point of emergence. The scrotal hairs are well isolated, and there is little chance of diffusion of the stimulus to neighboring follicles. The experiments on three subjects show that the removal of both innervations gives the same result as the removal of the upper innervation. There is every reason to assume that the papilla is not a sensory end-organ of any sort.

Removal of the Entire Follicle

When the follicles are entirely removed from a hairy surface, any response to light pressure must be due to end-organs in the skin surface.

Areas were selected on the scrotum where the single follicles are well defined; the skin is transparent and it is possible to locate and extirpate every follicle with certainty. The follicles were removed entire. The wounds were small, there was very little reaction (no local anesthesia was used) and the healing was very rapid. From 10 to 20 follicles were removed from each territory.

M. An area 2.5 sq. cm. was cleared; tested 24 hrs. after with probe showed some insensitiveness. Three days after, tested carefully with the v. Frey apparatus it was impossible to detect any change of the intermediate areas within the denuded territory. The scars themselves were slightly less sensitive.

K. 3 sq. cm. Tested three days after clearing. With v. Frey apparatus no difference could be detected save in the scars which were much below normal.

S. 2 sq. cm. Tested 12 hours after clearing. 'Pressure spots' of normal territory show lower threshold (14) than intermediate areas of either denuded or normal territories. Calls stimulation of normal 'pressure spot' "hair." Intermediate areas give the same reading (17) in normal and denuded skin. Tested after six days, the 'pressure spots' of normal territory have lowest threshold (15); intermediate areas in both normal and denuded skin give 17. The pressure spots of the normal areas are easily deformed. The scars of denuded area are thickened, and not easily deformed, and give a reading of 19-22.

L. 3 sq. cm. Tested 8 days after clearing. No difference could be detected between normal and denuded territories, save that the slightly indurated scars were less sensitive. The dilute alcohol used for asepsis had tanned and thickened all the skin slightly.

Ma. 3 sq. cm. Tested 5 days after clearing. No difference between the normal and denuded territories, save that the scars which do not deform easily, are not as sensitive as other areas. The normal 'pressure spots' are no more sensitive than the intermediate areas; they do not deform as easily as in the case of S.

W. 2 sq. cm. Tested 10 days after clearing. No difference between the normal and denuded territories, and threshold is not lower for the normal 'pressure spots,' which do not deform easily. The thickened scars are relatively insensitive and do not deform readily.

In all these cases, care was taken to test out several localities within and without the denuded territory, and to select places well within the denuded territory, so that there might be no possi-

bility of diffusion of the stimulus to normal end-organs. The tissue of the scrotum is so yielding and flexible that such transmission is improbable in any case.

In these cases the power of localization, the threshold for light touch and for tickle all seemed the same in the normal and in the denuded territories.

In the various operations on the hair follicle it is noteworthy that there are no pain endings found in the follicle. On the scrotum there are no pain endings to be found in the subcutaneous fibres. On the other surfaces, many pain endings are met with in the subcutaneous tissue. The scrotum gives but little pain sensation; the lower arm, lower leg, and point of hip are about equally sensitive; the leg just above patella gives very acute pain sensation and few subjects are able to bear operations there without local anesthesia. The differences in the sensitiveness to pain of different localities is very striking.

Examination of Extensive Scars

A number of large scars where the skin had been destroyed were carefully examined. The area was first searched for traces of follicles, which can easily be detected when the surface is rubbed down, moistened, and examined under a binocular with red light. Nineteen scars on 17 subjects were studied. The scars occurred on various parts of the body but mainly on the lower leg and lower arm. In most cases the threshold for pressure was below that of the bordering area; this varied somewhat with the thickness of the scar epidermis. Localization did not seem to be affected. Two scars which were heavily indurated and covered with a thickened skin, were quite insensitive, and did not give the results of the other 17.

An attempt was made to imitate the hair sensation on these 19 scar areas. Artificial 'hairs' were made 1) by inserting a fine elastic needle into the epidermis, 2) by cementing onto the scar surface a bit of hair-spring or fine wire bent at the base into a tiny foot. A stimulator consisting of a bit of reduced hair-spring tipped with a little ball of collodion was applied with quick taps.

In 17 cases, on as many subjects, it was easy to imitate hair sensations, so that the subject could not tell the false 'hairs' from the normal hairs of the bordering areas. The confusion was complete.

Artificial 'hairs' were mounted on three trained subjects on the back of the hand between the normal hairs. It was impossible to discriminate the false from the normal hairs.

Artificial 'hairs' were mounted on three trained subjects on the hairless palmar area (at ball of thumb on outer edge of hand) near the hairy area, and compared with normal hairs. Subjects were quite unable to distinguish between the false and the normal hairs.

These experiments with artificial hair sensations on scars and on the hairless areas tend to show that the hair sensation has no peculiar quality, but may be due entirely to the deformation of the skin surface, in the absence of hair follicles. In general the artificial 'hairs' seemed to give a less intense sensation; but there was no qualitative difference. In such work the method of asking the subject to discriminate between the real and the artificial stimulus gives convincing results; it is capable of extension to other types of skin sensation.

Conclusions

The hair as a sensory apparatus is like a willow shoot deeply rooted in loose sand. When the hair-shaft is moved the movement is greatest at the surface; pressure is exerted on the neural rings, etc., which make up the upper innervation of the follicle; often there is compression of the rings between the hair follicle and the surface; at the same time *the surface of the skin at the point where the hair emerges is freely moved.*

It is practically certain that the lower innervation of the papilla of the hair is not a sensory organ. The sensation of the hair, then, results from 1) the compression of the upper innervation (b in fig. 3) and 2) from the deformation of the skin surface at the point of emergence (a in Fig. 3). There is no qualitative difference between the two factors.

When pressure is applied to the 'pressure spot,' the resulting stimulus is complex: 1) there is stimulation of the skin surface at the point (a in Fig. 3), 2) compression of the upper innervation of the follicle (b in Fig. 3), and 3) deformation of the skin at the point of emergence by the pressure transmitted by the hair-shaft (a in Fig. 3).

Tests of denuded areas and of scars show that hair follicles are not essential to any variety of pressure or touch sensation, and that the threshold for pressure is but slightly lowered by the removal of the follicles.

In the hairy areas the end-organs for touch, then, are not confined to the hair follicles, but are found throughout the skin surface, and they are regenerated in epithelial scar tissue. The innervation of the hair papilla is not a sensory end-organ. The hair follicle is not furnished with endings for pain.

MECHANISM OF THE DIFFERENT TYPES OF MOVEMENT

R. H. Stetson

WITH A PRELIMINARY REPORT OF EXPERIMENTAL DATA

James A. McDill

The fundamental thing in the process called a movement is the muscular contractions; the extent of actual change of position of the member involved depends on conditions. The movement of the member is the usual purpose of muscular action and movement is often taken as the index of muscular action. In rapid, repeated movements it is probable that change of position of the moving member is of importance in the cycle of neuro-muscular changes on which innervation and coördination depend.

In the action of muscles against immovable or slowly moving resistance the individual muscular impulses are difficult to detect and the nature of the reaction is obscured. In the following discussion such actions are not considered. Movements are defined as reactions in which the contraction of the muscles affect the position of the moving member.

Classification of Movements

1. Fixation; in which groups of opposing muscles are contracted against each other. This is the movement of holding still.
2. The slow movement; in which the groups of opposing muscles are contracted but with uneven tension so that change of position of the moving member results. Often called the "controlled movement" because it can be changed at any point in its course.
3. The rapid movement; which cannot be changed at every point in its course but is usually determined entirely before the movement begins. The movement is a matter

of preliminary set, "Einstellung." Two kinds of rapid movement may be distinguished.

A. Movements in which there is a tension in all the opposing muscle groups throughout the movement.

B. Movements in which the contraction of the positive muscle group relaxes long before the end of the movement; the termination of the movement may be due to the contraction of the antagonistic muscles. This kind of movement was named by Richer "ballistic" because the moving member is actually free from muscular tension in the middle of its course and is carried on by its own momentum.

1. FIXATION—THE MOVEMENT OF HOLDING STILL.

All the various fixations of joints and members are of this type. Every ordinary distal movement requires a proximal fixation. Postures are of course movements of holding still. Recent work has shown that "muscle tonus" is merely a posture reflex.[1]

A record of the movement of holding still, as of a hand holding stylus or of a finger tipped with writing point, shows that the member is only approximately at rest. The member describes to-and-fro movements about a center. In a common form of the "steadiness test," a stylus is held in holes of varying diameter and the extreme amplitude of the movement determined. For the purpose of comparing and relating types of movement the number of tremors per second is more important than the amplitude. Luciani notes such a definite tremor in case of an outstretched arm.[2] He quotes Richet as giving 10-11 per sec. as the frequency of tremor. F. B. Dresslar studying rapid voluntary movement determined the tremor of the members involved:

Forearm—12.2. per sec.

Wrist, lateral—12.9 per sec.[3]

[1] Sherrington, C. S. Postural activity of muscles and nerves, Brain, *38*, '15, 191. Langelaan, J. W. On muscle tonus, *ibid.*, 235.

[2] Human Physiology ('13) '15, 563.

[3] Some influences which affect the rapidity of voluntary movements, Am. J. Psy. *4*, '91-'92, 514.

It has been assumed that this muscular tremor denotes the rate of synaptic reflex discharge through the motor nerve into muscles. Luciani quotes Horseley and Schäfer,[4] and Sherrington quotes Schäfer;[5] but more recent studies have made it clear that this unit of muscular movement cannot be referred directly to the frequency of impulses in the motor nerve.[6] The reflex motor nerve frequency is given as 50-150 per sec. And it is noted that there are 3-4 neural impulses for each muscle twitch. It is true that tetanus occurs in skeletal muscle if the frequency of the sensory stimuli is greater than 15 per sec.,[7] but this does not mean that there is a single motor impulse for each sensory stimulus; instead there is a train of motor impulses for each sensory stimulus.[8]

For some time the attention of investigators was centered on this frequency of c.50 per sec. as indicated by the action currents from the muscles. Recently De Meyer has published a series of studies in which he points out that the curves of previous investigators show other and lower frequencies superimposed on the c.50 per sec. rate. Laboratory work shows that there are currents of deformation of muscle due to any lengthening or shortening of muscle, as well as action currents due presumably to chemical changes in the myofibrillae.[9] The lower frequencies noted by De Meyer are of the order of 10 per sec., and are probably to be identified with tremor.

One might be inclined to say that the chemical changes which register themselves in action currents did not appear as actual

[4] *Ibid.,* 562.

[5] Integ. Act. N. Sys. 206.

[6] Beritoff, J. S. Zschr. f. Biol., *64,* '14, 161; and Piper, Arch. f. Anant. u. Phys., Ph. Abt., '14, 345; (Cited Gen. Rev., Psy. Bull., '16.)

[7] Starling, Prins. of Hum. Physiol., '12, 228.

[8] Beritoff, Ub. d. Erregungsrhythmik d. Skelettenmuskeln b. refl. Innervation, Zschr. f. Biol. *64,* '14, 161. Lucas, Keith, The Conduction of the Nerve Impulse, Lond. '17.

[9] De Meyer, J. D., Des differents sources de courants électriques des systèmes musculaires, p. 44. Sur les courants de déformation des muscles, p. 64. De la dualité d'origine des courants électriques produits par les muscles striés, p. 173. Arch. internat. de physiol. *16,* '21.

movements of the gross muscle, but merely as phenomena within the fiber. But the work of Hill using a direct record from the moving muscle (air tambour, hot wire to string galvanometer) shows that the rate of c.50 per sec. does appear in the movement of the member. It is difficult to imagine how the multitude of minute neuro-muscular processes can be kept in phase so that this rate is impressed on the mass movement, but the records are very clear. However, a second and lower frequency to which Hill does not call attention is very obvious in his published curves. There is too little material to make a very definite calculation, but apparently this lower frequency is c.10 per sec. and corresponds to the slower frequencies emphasized by De Meyer.[10]

Although nothing can be said as to the nature of this tremor frequency there is good reason for assuming that it marks the period of a unit of movement. Starling has shown that the duration of the cycle of the muscle twitch at the ordinary temperature is c.100-180 sig., 6-10 per sec.[11] In fibrillation of the muscle, a study of the continuous series of contractions shows that the rate of the fibrillar cycle is 10-20 per sec.[12] This unit movement appears in the various combinations which make up the types of movements.

2. Slow or "Controlled" Movements.

If the movement of holding still be extended in a given direction, it is evident that the beginning of the extension will be a tremor. If the attempt be to make a very small movement, the extent of a tremor will determine the extent of the movement which must consist of two or more tremors. The ability to make movements more and more minute is not limited by sensory methods of control, but by this fundamental tremor element of muscular action.[13]

[10] Hill, A. V., Tetanic nature of the voluntary contraction in man, J. Phys., *55*, '21, xiv.

[11] *Ibid.*

[12] Stevens, H. C., The cause of muscular atrophy following nerve sec. J. Am. Med. Ass. *60*, '18, 385.

[13] Work of L. T. Anderegg and J. Merle Scott in the Oberlin laboratory

When the movement is not so minute as to be limited by a few tremor lengths it is still apparent that the tremor impulses are present. Luciani states that a record of slow voluntary contraction of any muscle (e.g. the opponens of the thumb) shows undulations which are fairly regular in frequency—though irregular in amplitude—c.10-12 per sec. He quotes Griffiths' statement that an increase in frequency to 15-18 per sec. results when a load is applied to the moving member.[14]

Like the movement of holding still, a slow movement is due to the contraction of opposing muscles. In its simplest form the progress of the movement results from tremor increments in one of the muscle groups. Since the movement elements occur as frequently as 10 per sec. and since the increment is very slight, developing little or no momentum in the moving member, the movement can be changed at any movement element (tremor). No neuro-muscular provision is made in advance for the control of the movement. The slow movement is probably due to a series of slight increases in the algebraic sum of the number of muscle fibers contracting in the positive muscle group as against the number of fibers contracting in the antagonistic muscle group. This type of slow movement has been described and the essential difference in its mechanism from that of the fast movement has been discussed by Richer.[15] The sharp difference in type between fast and slow movements of the eyeball has been repeatedly noted.[16]

3. Fast Movements.

As a slow movement is increased in speed, the movement elements will be stretched out; their frequency remains the same but there will be fewer undulations per unit of length. For a

shows that magnification of the visual field does not improve the delicacy of minute movement. Quite as minute movements can be made without the eyes as with normal vision or with magnification.

[14] *Ibid.*, 562.

[15] D'Arsonval et autres, Traité de physique biologique, '01, Tome I, 156,

[16] Gertz, H., Üb. d. gleitende (langsame) Augenbewegung, Zschr. f. Ps. u. Ph. d. S. Abt. 2, (1), *49*, '14, 15. Dodge, R., Psy. Rev. *7*, '00, 454. Dodge, R., and Cline, T. S., Psy. Rev. *8*, '01, 155.

path of given length a speed should be possible at which the entire movement shall be a single stretched-out movement element. The movement will now be a smooth curve, a single undulation. The control of the movement will depend on a single impulse in the one group of muscles which starts the movement and on the intervention of a second impulse in the antagonistic muscle group which stops the movement (if it is a free movement without obstacle, like beating a baton in the air, writing, rapid shifting of the eyeball, etc.)

It is now apparent that such a rapid movement cannot be subject to control after it is once started; movement elements occurring at the rate of 10 per sec. are the units; at most then movements can be modified not oftener than ten times in a second. A movement occurring at the rate of 10 per sec. and consisting therefore of a single movement element and terminated by the following movement element must be the result of an adjustment preceding the entire movement. The movement at maximum rapidity is controlled by a preliminary "set," "Einstellung."

A. *Fast Movement under Tension.*

If the fast movement be considered as developed from the position of fixation of the moving member the movement may be due to a sudden excess contraction of one of the groups of muscles making up the complex of muscle groups involved in holding still, followed by an excess contraction in the antagonistic muscle group which stops the movement. A movement of translation is thus superimposed on the fixation, and the movement occurs under tension. Not only are the muscles contracted which have to do with guiding the movement (Du Bois Reymond's pseudantagonistic synergie) but the positive muscle group and the antagonistic muscle group also maintain a tension against each other throughout the movement.

B. *The Ballistic Movement.*

The ballistic movement is a common form of the fast movement; it consists of a single unit contraction of the positive muscle

group followed by a unit contraction of the antagonistic muscle group. The moving member is not under tension from both muscle groups; the movement of translation is not superimposed on a fixation. Instead, a single tremor impulse of the positive muscle group starts the movement; the contraction of this impulse dies out before the second tremor impulse of the antagonistic muscle group appears to check the movement. There is therefore a median part of the movement in which the moving member swings free carried by its own momentum. There may be fixation of a joint and there is the guiding tension of muscle groups which determine the path of the movement, but there is no opposing tension to the flight of the moving member.[17]

In a to-and-fro movement at maximum speed the unit contraction which checks the one movement becomes the driving impulse for the reverse movement, relaxing before the positive unit contraction reappears to check the reverse movement and start the moving member on its second flight. Such a to-and-fro movement ought to approach very close to the tremor rate as indeed it does. F. B. Dresslar's observation that the maximum rate of tapping is c.10.5 per sec., while the tremor rate for forearm and wrist is 12.2 and 12.9 respectively should have been taken as evidence that the two values are closely related and not that they are due to distinct processes.[18]

T. G. Brown makes the fundamental unitary mechanism to consist of the efferent neurones of two antagonistic muscles.[19] It is possible that the maximum rapidity of a repeated movement is limited by the rate at which excitation and inhibition can be developed in two antagonistic muscle groups. If one assumes that inhibition is due to the combination of trains of excitation in pulses in the motor nerves (K. Lucas, Verworn, etc.) it may well be that the overlapping of the series to produce the continuous refractory condition followed by the normal conducting condition has a definite time limit. It is probable that the me-

[17] Richer, P., *loc cit.*

[18] Some influences which affect the rapidity of voluntary movements, Am. J. Psy. *4*, '91-'92, 514.

[19] J. Physiol. *48*.

chanical change due to movement is an important factor in the coördination.

The fast movement under tension and the ballistic movement have not always been distinguished. But in many types of skilled movement the distinction is important. In piano playing, in violin playing, and in telegraphy the contrast between the "tight" or "stiff" rapid movement (fast movement under tension) and the "loose" rapid movement (ballistic) has come to be a commonplace. Piano technic has been recognized during the past thirty years on that basis.

At the highest rate of repetition there can still be variation from movement to movement if not during the flight of any single movement. Although the duration is fixed the extent of such movements is subject to wide variation. This has been noted in several movement studies.[20] The ballistic movement is capable of the most delicate adjustment, in extent as in the case of writing and keyboard manipulation, and in force as in case of dynamic shading in violin or piano playing, singing, speech, etc.

Since the duration of the rapid movement is fixed, there can be but two variables, extent and force. This limits somewhat the problem discussed by Morgan and Goerrig.[21]

Experimental Results.

Tremors in fixation of finger—movement of holding still.

The right hand was supported on table in comfortable position. A writing point, the point of a sharp needle, was fastened to the

[20] Stetson, R. H., Theory of rhythm and discrete succession, Psy. Rev. *12*, '05, 261. Isserlin, M., Üb. d. ablauf einfacher, willkürlicher Bewegungen, Psy. Arb. *6* (1), 1910-14, 86, who states clearly that the total duration of rapid movements remains the same for a given person no matter what the extent of the movement. Freeman, F. N., Anal. of the writing movement, Psy. Mon. Sup. *17*, '14, No. 4, 1-46, who confirms Binet and Courtier in statement that in case of rapid writing movements the increase of extent of a single movement, or of the writing as a whole, does not mean an increase in duration of the stroke or strokes, but rather increase in speed; the time of rapid writing is independent of its size.

[21] Morgan, J. B., The speed and accuracy of motor adjustments, J. Xp. Psy. *2*, '17, 225. Goerrig, M. A., Einfluss d. Zeitdauer auf d. Grossenschätzung v. Armbewegung, Arch. f. d. ges. Psy. *36*, '17, 293.

nail of the index finger. The other fingers and thumb rested on the table while this index finger was held extended with the writing point in contact with a smoked glass slide perpendicular to the table, so that the finger movements were recorded in the vertical plane. A Jacquet chronograph marking fifths of sec. on the slide afforded a record of time intervals. The glass slide was drawn in a groove by a thread winding on a kymograph drum running at rather slow speed.

The records were measured under a Zeiss binocular microscope. To avoid errors each change in direction was counted and the result divided by two. The slides were labeled, the smoked record mounted with cover glass and balsam in the usual manner.

Subject W Record of	9 seconds; average per sec.	6.8	Mean variation .8
	13	8.2	1.
	7	8.2	1.1
	8	8.1	1.1
	8	7.8	1.3
	10	7.7	.7
	10	7.7	.9
	7	7.3	.8
	8	6.5	.9
	11	7.3	.5
	4	7.	.9
Subject A	5	7.4	.9
Subject N	7	8.	1.5
Subject D	5	6.9	.3

These records show a fairly definite frequency which varies somewhat from sitting to sitting and from subject to subject. The mode is c.7.5 per sec. which is somewhat lower than other results but not significantly so.

Tremor-undulations in various types of movement at various speeds:

Short, straight lines of 3-4 mm. were drawn with the ordinary writing movement of fingers and hand at speeds varying from 14-160 per minute.

Longer lines of 440 mm. were drawn with pencil by movements of the forearm and upper arm, at speeds varying from 14-160 per minute.

The short lines of 3-4 mm. were drawn on smoked glass slides, the click of a metronome indicating the beginning and end of the parallel lines. There are several sources of possible variation: the speed of the movement may vary, and the movement may not occur within the indicated time interval. As the movements are repeated and rhythmic, these variations are limited and tend to compensate. The lines were measured under the microscope and averaged in groups of 30.

Subject A

30 lines,	14 lines per min.	4.28 sec. per stroke,	10.1 undulations per sec.	m.v. 1.1
30	22	2.72	12.2	2.4
30	48	1.25	15.3	1.1
30	60	1.	12.3	1.6
30	70	.86	11.7	1.4
30	80	.75	11.2	1.4
30	90	.67	11.4	1.7
30	100	.60	10.5	1.4
30	110	.54	9.8	2.
30	120	.50	9.8	1.8
30	130	.46	10.6	2.1
30	140	.42	11.1	2.2
30	150	.40	11.5	1.9
30	160	.37	11.3	1.8

Although there is considerable variation, it is clear that the "undulation" marks some definite frequency which remains fairly constant throughout the series. This tremor undulation indicates some fairly constant element in the movement; it is possible that the record is of impulses in the "pseudantagonistic" muscle groups rather than in the driving muscles; but slow movements like that of closing the fingers show that driving muscles also have the same pulses. Although these movements are approximately of the same length, the slowest movement has an average of 43 of these elements, and the fastest movement has an average of 4.

The longer lines of 440 mm. were drawn between limiting perpendicular lines on smooth cardboard sheets with a hard pencil; the beginning and the end of the line was indicated by metronome click. In studying the lines, the sheets were placed on inclined plane to bring one end nearer the eye; by "squinting" down the fore-shortened line the undulations could be counted.

Subject P

30 lines.	8.4 lines per min.	4.4 undulations per sec.	M.v. .9
30	14	5.6	.8
30	22	6.	
30	42	6.9	
30	48	7.9	2.
30	60	7.6	1.7
30	70	8.2	
30	80	7.7	
30	90	8.	
30	100	8.2	
30	110	8.6	
30	120	8.3	
30	130	7.7	
30	140	8.1	
30	150	8.1	
30	160	8.1	2.2

There is more variation from rate to rate than in the record of short lines; the mean variation at a given speed is about the same as for the shorter lines. It is to be expected that the frequency of the tremor-undulation would be somewhat slower when larger muscles are involved; it is a familiar fact that the maximum rate of larger muscles is slower.

Certain difficulties are involved in starting and stopping at a limiting line when drawing lines by the above method. To avoid these difficulties a series was made in which the pencil was in motion when passing the limiting lines; a flying start and a flying

Subject M.

30 lines.	14 lines per min.	4.2 undulations per sec.	M.v. 1.1
30	22	5.8	
30	48	9.5	
30	60	6.	
30	70	6.2	
30	80	6.8	
30	90	6.8	
30	100	7.8	
30	110	6.9	
30	120	6.2	
30	130	6.8	
30	140	7.3	
30	150	6.8	
30	160	7.2	2.4

stop. A possible source of error may lie in the varying accuracy with which the subject drew the pencil across the limiting lines on the click of the metronome. The length of line measured was 300 mm.; the number of undulations was counted as before.

These records of tremor frequencies agree very well with material previously published. But there are too few subjects for the various types of movement. There are records from only three for the study of tremor in fixation, records from only two for the study of the longer movements, and records from only one subject for the study of small movements. The results although insufficient are fairly consistent and indicate a single unit frequency in all sorts of movements at varying speeds. This unit frequency is very close to the maximum frequency of voluntary movement for the given groups of muscles.

The Termination of Skilled Movements.

The purpose of many skilled movements is achieved at the end of the stroke; there the work is performed, the blow struck. Although the entire path of the movement is important in the case of a few movements like writing, drawing, use of surface-working tools and some phases of musical conducting, yet for such movements there is always a definite termination.

The terminations of movements may be classed as follows:

1. The moving member swings loose about joint; movement is terminated by ligaments and passive muscles.
2. The moving member is arrested by the antagonistic muscle group.
3. The moving member is arrested by an obstacle, a "block."

1. The form of movement in which the moving member is brought to a stop by the ligaments and passive muscles is rather unusual; the movement of the hand in plucking the balalaika and the swing in golf are illustrations. In pitching a baseball the muscles are brought into play enough to hold the arm in position after the delivery but the termination of the movement is due primarily to the passive tissues about the shoulder joint.

2. The moving member is brought to a stop by the antago-

nistic muscle group in the "free" or self-limiting movement. The movements are often executed in the air without any resistance as are most gestures and the movements of the orchestra conductor. All the movements of the eyeball are self-limiting. Many calisthenic and athletic exercises involve such movements either untrammelled or against a slight resistance. Auxiliary arm movements in walking, running, and dancing are quite free. Club swinging, and wand drills involve movements against a slight resistance. In rowing and swimming the resistance is more pronounced but the end of the movement is determined by the opposing muscles. The movements of writing and drawing meet a slight resistance; surface working tools involve varying degrees of resistance. In speech repeated vowels and liquids require self-limiting movements of large muscles. Violin bowing and the manipulation of the slide trombone involve self-limiting movements against a slight resistance. In plucking the harp or guitar string the movement creates a sharp, elastic resistance, releases it and passes to a limit fixed by the muscles themselves.

Only a few self-limiting movements are terminated by the contraction of the antagonistic muscle group acting directly against the contraction of the positive muscle group. Slow movements of the "controlled type," are stopped by the increased tension of the antagonistic muscles and there is little momentum to be taken up.

Wherever the movement must be delicately gauged as to point in time, degree of force, or exact form of movement a fast, "ballistic" movement is used; the "back stroke" and the preparation for the movement may be slow and there may be long pauses between "beat strokes," but the stroke itself is a fast movement. If the ballistic movement comes to rest at its termination, there is a fresh contraction of the positive muscle group with other muscles involved in maintaining the position of the member. Repeated movements at maximum speed show no period of standstill; the end of the movement presents a remarkably sharp angle. The flight of the moving member initiated by the positive muscle impulse meets the gradually increasing tension of the antagonistic muscle group which reverses it. The

change of direction is almost instantaneous like the rebound of an ivory ball from a hard surface, or of a light weight with an elastic spring. Rieger observed this rebound and referred it to the positive muscle group.[22] Isserlin is right in objecting to this interpretation but wrong in assuming that a pause must intervene. It is quite true that in repeated fast movements there is a definite "relaxation" process in the sense that the momentum of the moving member must be taken up and the contraction of the antagonistic muscle group developed; but in the swifter ballistic movements the moving member is descending and rising without pause during this "relaxation period."

3. In a very large group of skilled movements the moving member meets an obstacle, a block which stops the movement without further muscular activity; whereupon in most cases the antagonistic muscles presently contract and return the moving member to the initial position. At medium speeds the block may be said to truncate a complete movement which would swing to a later termination coming to a stop with the contraction of the antagonistic muscle group; instead there is a period of rest at the block during which the antagonistic contraction takes place. As a repeated movement to a block approaches maximum speed, the pause grows less and less; finally the block becomes a mere limit, the angle of reverse becomes sharp and the form of the movement has become of the self-limiting type. Slow movements may rest at the block and perhaps exert some pressure on the block; but for the highest speed there must be no pressure whatever on the block.

Many of the skilled movements of musical performance are against a block; piano and organ playing, fingering of strings and wood wind and the brass. In piano playing rapid octaves if played properly will actually exert very little pressure on the pad beneath the keys. In typing and adding machine work also keys are pressed down through slight resistance to a definite block. Sometimes the blow is delivered to a resisting surface as in the various movements of locomotion and in many of the consonant

[22] Üb. Muskelzustände, Zschr. f. Ps. un. d. S. *31*, l. *32*, 377.

strokes of speech. Sometimes the external resistance is elastic although powerful enough to check, and even to reverse the movement; leaping from a spring board, dancing on a tight rope, and beating the various drums are terminations of this type.

Blocked movements, movements with and without resistance, and self-limiting movements frequently occur side by side and are nicely organized as in the work of an orchestra. The delicacy of expression and celerity possible in methods of execution as different as those of the piano, violin, harp, and voice show that there may be a remarkable control of any of these forms of termination of the skilled movement.

Experimental Results.

It is easy to show that the nature of a movement is not affected by the fact that it meets increased tension during a part of its extent, nor by the fact that it comes up against a complete block. If the increased tension is small as compared with the weight of the moving member, there is no change in the curve representing the movement and it sweeps to the end without perceptible change. The muscular contractions for stopping a self-limiting movement and for returning the member if the movement is repeated are adjusted to the external tension; the form of the movement is in nowise affected.

Figure 1 shows a movement of the hand and arm making an excursion of 150-250 mm. During the lower 50 mm. of the free excursion the hand strikes a platform of small mass suspended by elastic bands which give a tension increasing to 150 g.

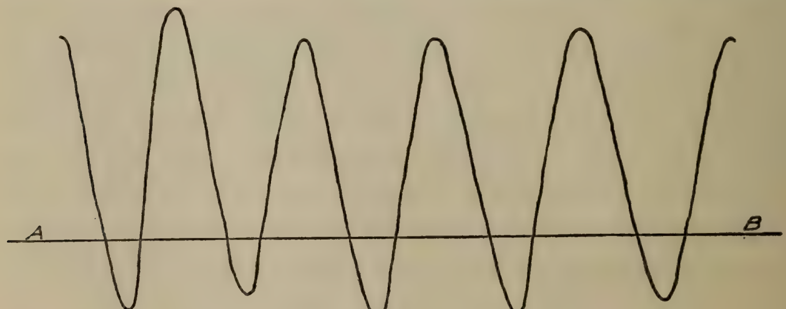


FIG. 1.

at end of stroke. There is no indication of a change in the movement when the hand comes in contact with the platform.

Subject blindfolded. Platform raised and lowered rapidly through 60-70 mm. Tension 350 g. Points at which platform is raised-and-lowered are marked "*".

Duration of platform movement, sec.	Extent of platform movement, mm.
.27	46
.27	52*
.22	41
.22	41
.26	51*
.22	41
.20	36
.23	47
.23	50*
.25	46
.21	36
.19	41
.19	44
.19	41
.20	50*
.20	42
.18	34
.19	43
.23	49
.24	53*
.21	40
.21	36
.21	40
.23	56*
.22	43
.21	38
.24	50
.24	50*
.17	27
.22	38
.27	53
.28	48*
.18	28
.26	46
.30	65*
.25	38
.23	29
.26	37

Here the change of level of the platform has been made rapidly enough so that there is no readjustment. The movement dips into the platform tension and goes deeper when the platform is

Duration of platform movement, sec.	Extent of platform movement
.31	55
.29	51*
.27	42
.27	46
.26	40
.26	40
.26	35
.26	31
.31	44
.37	58*
.36	46
.30	47
.22	32
.18	15
.20	31
.27	43
.25	48
.28	55*
.26	53
.27	51
.22	45
.30	56
.27	55
.27	51*
.27	55
.24	46
.23	49
.24	45
Change of platform level 110 mm.	
.23	40
.22	40
.24	43
.24	45
.23	43
.23	40
.25	51*
.22	42
.23	39
.19	36
.22	41
.25	43
.23	37

raised and comes back immediately to the original movement form when the platform is lowered to the normal position. The duration and extent records show that roughly the same speed is maintained throughout.

Subject blindfolded, makes free strokes which carry down the elastically suspended platform. The level of the platform is raised and lowered slowly; the points where platform is at maximum height are marked "*". Change of level 60-70 mm. Tension 350 g.

Where the changes of level are made gradually the tendency to readjust is apparent; the movement is adjusted by the preceding movement sensations, not by the sensations from the movement occurring. There are many illustrations of this adjustment in ordinary life: adjusting to the dimensions of the steps as one climbs a staircase; adjusting to the touch of a strange piano or typewriter: adjusting to a novel height of heel in walking, etc. Some eighteen series of records of this sort were taken at various speeds of ballistic movement; they all show the same facts as those given above. The records are from but a single subject, however, and need corroboration.

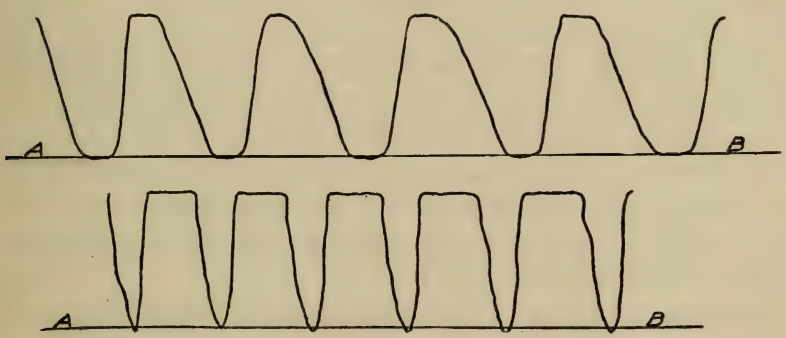


FIG. 2.

When the movement plays against a block, a very common form of rapid stroke, if the movement is slow, the member rests at the block and the curve looks precisely as if a longer self-limiting movement had been truncated by the block. Series 1) if completed would have been 60-70 mm. in length. The momen-

tum and possibly some contraction of flexor muscles is expended at this block level and the extensor contraction which is to raise the arm and hand develops during this period of rest.

If the speed of the movement to the block is increased to 1.4 per sec. the form of the movement changes and the pointed end of the movement occurs at the block, Series 2); there is no longer a period of rest at the block. Very little energy is expended on the block; the momentum developed in the moving member is quickly neutralized by the extensor muscles and the moving member is thrown lightly back from the block level.

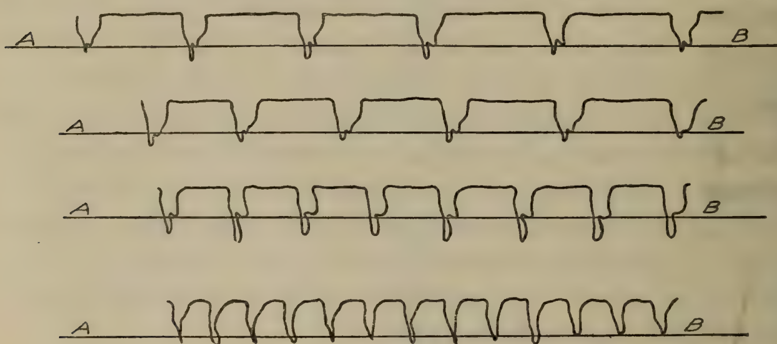


FIG. 3.

If the distance from the normal level of the platform to the block is small, 5-15 mm., e.g., the tendency to rest at the block is more pronounced and the pause at the block is apparent in Fig. 3 in 1) .6 per sec., M.M 36, in 2) 1.8 per sec. M.M 108, and in 3) 2.1 per sec. M.M 126. But in 4) at the speed of 4 per sec. M.M 240 the pause has disappeared and the path of the movement barely touches the block. Cf.[23]

A number of records of this type from the one subject are all consistent but there is need of records from more subjects.

Bearing on the Type of Movement on the Process of Learning

1. The "form" of the movement:

Wherever rapid and repeated movements are important as in musical technic, use of keyboard machines, telegraphy, writing,

[23] Mot. Theory of Rh. and Discrete Suc. Psy. Mon. Sup. *12*, '05, 263.

and shorthand, the type of movement has been recognized as very important. Keyboard work has been completely reorganized on the basis of the "loose" movement which is simply a carefully maintained ballistic movement of finger, hand, and forearm with the use of weight of momentum as far as possible. Telegraphic keys have been modified and the technic emphasized because both speed and freedom from occupational neurosis depend on obtaining the ballistic form. In writing it happens that a remarkable piece of early work was done in the development of the ballistic technic. Spencer not only developed remarkably good cursive forms of the written letter, but he also achieved a technic of the writing movement which gave great speed and endurance with beauty of form. There are careful directions for the "muscular movement," in which the forearm slides freely and ballistically about on the mass of flexor muscles and tight, cramping movements of the finger and hand are avoided. Chinese and Japanese brush writing and drawing have also achieved the fast, free stroke. The line of Japanese painting is a free hand and free arm drawing with the swift certainty of the skilled ballistic movement. The bad line in drawing is the result of "controlled" movements. In many of these skilled movements, piano playing, telegraphy, Spencerian writing for example, the form of the movement is more or less conscious and the method of training for getting the technic is fairly adequate. But in many skilled processes the ballistic form of the movement is the result of chance or the movement goes on hampered by opposing tensions.

2. The development of speed; transition from the slow to the ballistic movement; problem of the plateau of the learning curve.

A few skilled movements like diving or serving at tennis must be practiced at speed from the start, but most of the complicated skilled movements are begun slowly and gradually increased in speed. Mistakes in the precise path of the movement are usually counted lapses in "accuracy." These are kept to a minimum and constantly corrected while the movement is repeated at higher and higher speed. This is the great feature of the process called

training or "development of skill." It is usually assumed that the movement is being stereotyped, ground in by repetition, and that the increase of speed is merely a matter of gradually increasing the tempo while the movement remains the same. First get the path of the movement accurately and then gradually speed up until you reach the normal tempo. On the assumption that it is one and the same movement process at the different speeds it has always been something of a puzzle that the learning curve fails to show a regular increase in speed Instead of a gradual and regular increase, the curve shows rather rapid gains at points with long periods of practice between during which there is no apparent gain at all. There are various explanations: periods of assimilation in which recent gains are being consolidated; compensation between improvement and fatigue, etc. The fundamental fact is that the movement itself changes with the increase in speed; it is not the same movement throughout training. Beginning as a slow process composed of many movement elements and with frequent pauses, the increasing speed means that fewer movement elements must take the place of the many. The *path* of the movement has not changed but a process which included twenty movements, and might be stopped at twenty different places and may have paused at many of them, is now reduced to fifteen, to seven, to three. In reality passing from slow to rapid is a matter of substituting a single movement for several movements over the same path. Nothing else can happen; if about ten movement elements per second is the maximum, a given movement beginning with ten movement elements must be reduced to less than ten movement elements when the speed exceeds one per second. If the given movement takes place at the rate of two per second the original ten movement elements must be reduced to at most five. When the beginner prints a character at the typewriter he first puts his finger on the key, and then presses it down; later the placing and striking must become one stroke. In many cases different groups of muscles are employed for the slow and the rapid movements; the movements are different in every sense, they consist of different numbers of grouped movement elements

executed by different muscle groups. And this fact must have an important influence on the learning curve. When the "form" of the movement is stable, when the number and grouping of the movement elements is no longer changing, the increase in speed is very slow indeed but is gradual—as at the end of training when the subject comes very slowly to his maximum efficiency. It is perhaps due to gradual nutrition changes ("development" of muscles) and to the refinement of the cues and adjustments which direct the movement. But during a large part of the obvious and relatively rapid improvement, the "form" of the movement, the actual movement-process is subject to change. When a new and more condensed group of movement elements is substituted for the more detailed and segmented group there is a very rapid increase in speed. But these new "forms" of movement, these new combinations of the individual units are blundered into. During the plateau the subject is repeating the movement verbatim until chance gives a better way and he falls into a better "form." "Plunging" at the expense of mistakes has its advantages for thereby the subject comes to new and more rapid "forms" for covering the same movement path. The advantage of ensemble playing for the beginner in music is that it forces him to try things at a speed which compels new combinations, with approximate accuracy in the main movements at least. Mere repetition does not constitute fruitful practice; changes in the type of movement used are essential.

Summary

Movements may be classed as 1. movement of holding still —fixation, 2. slow movement, 3. fast movements, A. with tension, B. Ballistic. The difference between these classes is due to the number of movement elements in each type of movement. The movement elements are equivalent to the tremor undulations. In fixation a number of muscle groups contract against each other and the tremor is the only change of position. In the slow movement there are a large number of movement elements per unit of length and the movement can apparently be changed at any

point in its course; it is "controlled." In the fast movement there are few elements, only a few changes are possible; at the maximum rate when each stroke consists of but one element, no change during the course of the movement is possible. In the fast movement under tension the movement of translation is superimposed on a movement of fixation. In the ballistic movement there is a minimum muscle contraction during the flight of the movement. A single impulse of the positive muscle group starts a very rapid movement; during the earlier course of the movement this impulse ceases and the moving member swings free to the termination of the movement. Such a ballistic movement will have a duration independent of the extent of the stroke; long or short, the movement can be repeated at a maximum rate which approaches the tremor frequency of the groups of muscles involved.

There are three common forms for the termination of a movement: 1. the moving member swings loose and is arrested by ligaments and passive muscles, 2. the moving member is arrested by the contraction of the antagonistic muscle group, 3. the moving member is arrested by an obstacle. The first form is less usual; the second is the common type or "free" or self-limiting movement; the third is very common in all sorts of rapid manipulation of mechanical apparatus. When the movement terminating at an obstacle occurs at maximum speed it tends to become self-limiting.

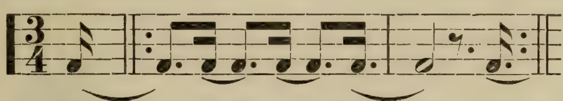
In training the type of the movement changes from slow to ballistic although the path of the movement does not change. Plateaux in the learning curve are due to periods in which the movement is repeated without change of type and therefore at the same speed. Devices in training are important which lead to the development of new "forms" of the movement.

MEASUREMENTS OF RHYTHMIC UNIT-GROUPS AT DIFFERENT TEMPOS

R. H. Stetson and T. E. Tuthill

The fundamental groups of a rhythmic series consist of accented and unaccented beats. In musical notation it has been customary to give these beats a strictly quantitative expression. It is assumed in musical instruction and occasionally in psychological theory that the quantitative temporal relations are an essential factor in the unit-group.

The iamb or "dotted-eighth-sixteenth" figure was chosen as one of the simplest and most obvious unit-groups with a pronounced difference in the length of the elements and a very definite accent. The question was raised: Is the musical iamb actually played in a fixed temporal form as indicated by the musical notation? The commonest form of the iamb was chosen and a half dozen trained musicians were asked to play this rhythm at different tempos; the records were carefully measured. The form that the musicians were asked to play was always a simple phrase:



The rhythms were tapped on a key which gave a clear sound like that of the Vergil clavier with which all the subjects were familiar. The beats were recorded on a carefully controlled kymograph drum. The subjects were all accustomed to ensemble playing, were considered accurate in rhythm, and were all aware that the "accuracy" of their rhythms was to be tested. They did their best to make the form correct as they conceived it.

The following tables show a sample of the actual measurements in one case and of the computed averages and mean variations for the series of readings of the records of each of the six subjects.

Records of doublets and triplets (trochees and dactyls) have been added for comparison.

TABLE I

Subject W.

Iambs

Readings in tenths of millimeter from kymograph drum.

Metronome rate	50		80		100		120	
	𝅘𝅥𝅯	𝅘𝅥𝅮.	𝅘𝅥𝅯	𝅘𝅥𝅮.	𝅘𝅥𝅯	𝅘𝅥𝅮.	𝅘𝅥𝅯	𝅘𝅥𝅮.
	173	561	315	840	137	410	170	706
	168	526	285	755	125	370	167	683
			306	764	132	415	172	682
	168	506	292	765	120	405	172	677
	175	490	292	700	127	377	170	631
			307	663	120	416	160	630
	251	830	278	674			148	681
	262	830	280	666	147	460	158	690
	242	796	234	570	148	442	170	665
			240	640	136	477	147	676
	213	702	233	617	152	476	145	650
	240	762	237	616	170	485	160	668
	240	730	230	634	167	475	154	650
					160	496	152	640
			315	849			158	650
			313	810	175	450	160	663
			321	807	503	184	170	650
					182	488		
					196	503		
					170	510		

Averages; ratio of the short note to the long note:

M.M.	50	80	100	120
Theoretical ratio, assuming that the iamb is a quantitative expression	250:750	250:750	250:750	250:750
W.	240:760 mv 30	284:716 mv 30	252:748 mv 10	190:810 mv 10

Subject W

M.M.	40		80		120		160		180	
	180	400	135	400	160	400	145	280	140	235
	180	500	170	390	165	400	140	260	130	220
	195	510	165	520	170	420	130	290	120	215
	180	470	200	500	170	420	135	300	120	215
			190	510					145	225

Averages:

Theoret.	250:750	250:750	250:750	250:750	250:750
W.	275:725 mv 7	268:732 mv 27	290:710 mv 6	323:677 mv 13	366:634 mv 22

At the slower tempos M.M. 50 and 80 many of the individual figures are far enough from the theoretical ratio so that the difference could easily be detected by the ear. The average values are not far enough from the theoretical ratio so that the difference could be detected by the ear. The average at M.M. 120 is far enough from the theoretical ratio to be at the threshold of discrimination, 40-66 sigma. It is to be noted that at none of the tempos do the values vary about the theoretical ratio as a norm.

In the second series from the subject W. it is to be noted that the forms do not agree with other records from the same subject, save in having the short note in general longer than the theoretical value.

TABLE II

Subject M

Averages of readings expressed as ratios

M.M.	40	80
M.	346:654 av. 14 rdgs mv 59	312:688 av. 11 rdgs, mv 12.
Theoret.		
	250:750	250:750
M.M.	100	120
M.	294:706 av. 17 rdgs, mv 12	267:723 av. 15 rdgs, mv 13
M.M.	140	180
M.	285:715 av. 14 rdgs, mv 11	326:674 av. 20 rdgs, mv 13.

TABLE III

Subject D

Iamb

Averages of readings expressed as ratios

M.M.	40			80			
D.	331:669	av. 7 rdgs,	mv 16	366:634	av. 9 rdgs,	mv 15
	283:717	5	4	354:646	8	14
Theoret.						
	250:750			250:750		
M.M.	120			160		
D.	315:685	av. 8 rdgs,	mv 6	316:684	av. 7 rdgs,	mv 9
	335:665	5		316:684	7	13
Theoret.						
	250:750			250:750		

In Table II the individual unit-groups show values at all tempos which could easily be discriminated by the ear from the theoretical ratio. In the case of M.M. 40 and 80 the average of the readings is so unlike the theoretical ratio that the difference would be obvious to the ear. As often, the mean variation shows greater irregularity at the slow tempos.

The divergencies from the theoretical ratio at the lower tempos as shown in Table III are pronounced and would be obvious to the ear.

TABLE IV

Subject H

Iamb

Averages of readings expressed as ratios

M.M.	40			80		
H.	400:600	av. 10 rdgs,	mv 24	393:607	av. 8 rdgs,	mv 8
	370:630	8	22	373:627	10	26
	362:638	10	4	353:647	8	14
Theoret.						
	250:750			250:750		
M.M.	120			160		
H.	364:636	av. 11 rdgs,	mv 47	366:634	av. 10 rdgs,	mv 26
	335:665	10	17	330:670	6	10
	330:670	7	16	354:646	7	7
Theoret.						
	250:750			250:750		
M.M.	200					
H.	354:646	av. 9 rdgs	18			
	360:640	av. 14 rdgs	14			
	344:656	av. 7 rdgs	34			
Theoret.						
	250:750					

At all tempos in all three records in Table IV, the short note of the unit-group is much longer than the theoretical value, and as a rule is longer than that given by other subjects. In nearly every case the individual unit-group as played could be discriminated by ear from a figure played with the theoretical values.

The type used by the subject is very definite; there is little variation at any tempo.

TABLE V

Subject P
Iamb
Averages of readings expressed as ratios

M.M.	40			80			
P.	325:675	av. 4 rdgs.	mv 13	318:682	av. 8 rdgs,	mv	9
	342:675	4	10	240:760	8		14
	263:737	4	8	251:749	5		12
	348:652	5	7	222:778	3		0
Theoret.							
	250:750			250:750			
M.M.	120			160			
P.	283:717	av. 4 rdgs,	mv 0	362:638	av. 4 rdgs,	mv	33
	303:697	6	10	299:701	6		18
	308:692	5	6	325:675	5		30
	246:754	4	0	276:724	3		0
Theoret.							
	250:750			250:750			

The number of readings recorded in Table V is rather small.

TABLE VI

Subject S
Iamb
Averages of readings expressed as ratios

M.M.	40	80
S.	262:738 av. 6 rdgs, mv 18	352:648 av. 11 rdgs, mv 10
Theoret.		
	250:750	250:750
M.M.	100	120
S.	366:634 av. 10 rdgs, mv 18	325:675 av. 12 rdgs, mv 6
Theoret.		
	250:750	250:750
M.M.	140	160
S	380:620 av. 12 rdgs, mv. 20	400:600 av. 12 rdgs, mv. 24
Theoret.		
	250:750	250:750

Iamb at tempos which increase by small intervals. Mean variation as usual.

M.M.	40	50	60	72
	359:641 av. 10 rdgs		249:751 av. 10 rdgs	
	360:640 10	409:591 av. 10 rdgs	457:543 10	375:625 av. 10 rdgs
	317:683 10	348:652 10	361:639 10	409:591 10
Theoret.			355:645 10	332:668 10
	250:750	250:750	250:750	250:750

M.M.	84	96	108	112
	351:649 av. 10	323:677 av. 10 rdgs	409,591 av. 10 rdgs	364:656 av. 10 rdgs
	336:664 10	390:610 10	376:624 10	
Theoret.		388:612 10	350:650 10	
	250:750	250:750	250:750	

M.M.	126	140
	340:660 av. 10 rdgs	348:652 av. 10 rdgs
	250:750	250:750

In the records of Table VI the short note of the unit-group is longer than the theoretical value; this is in accord with the records of other subjects. In the case of the slower tempos and occasionally at the higher tempos, the difference is large enough to be easily recognized by the ear.

It is apparent that the type of iamb may change, not only from subject to subject, but from time to time with the same subject; though the coördination is maintained when once established. For example in Table VI at M.M. 40, the type 260:740 is decidedly different from the type 360:640. So also at M.M. 60, type 250:750, type 460:540, and type 350:650 are decidedly different. The variation within each of such a series is slight, showing that the averages are not accidental.

Table VII shows the usual variations. M.M. 40 there are two types of iamb apparent, type 240:760, and type c.340:660. All the other figures are fairly uniform. With the exception of the single case just mentioned at M.M. 40, the averages show a type in which the short note is longer than the theoretical value.

TABLE VII

Subject T

Iamb

Average of readings expressed as ratios

M.M.	40		60		80	
	243:757	av. 11 rdgs, mv. 14	340:660	av. 13 rdgs, mv. 27	248:752	av. 13 rdgs, mv. 12
	358:642	10			242:758	10
	369:581	10			299:701	10
	300:700	6			313:687	10
	329:671	10			276:724	8
	343:657	7			357:643	9
	313:687	9				
	331:669	10				
Theoret.						
	250:750				250:750	

M.M.	100		120	
	272:728	av. 13 rdgs, mv. 9	300:700	av. 11 rdgs, mv. 6
			283:711	10
			317:683	10
			290:710	10
			284:716	10
			287:713	11
			320:680	10
			309:691	9
Theoret				
	250:750		250:750	

M.M.	140		160	
	342:658	av. 12 rdgs, mv. 27	294:706	av. 10 rdgs, mv. 18
			314:686	10
			347:653	10
			352:648	10
			385:615	10
			331:669	10
			327:673	10
Theoret.				
	250:750		250:750	

TABLE VIII

Subject H

Trochee doublet ()

MM. 40	80	
513:487 av. 8 rdgs, mv. 15	525:475 av. 7 rdgs, mv. 19	
518:482 4	502:498 9	
Theoret		
500:500	500:500	
M.M. 120	160	200
509:481 av. 11 rdgs, mv. 9	440:560 av. 10 rdgs	507:493 av. 10 rdgs
515:485 8	505:495 9	
Theoret.		
500:500	500:500	500:500

Subject S

Trochee, doublet ()

M.M. 80	100
580:420 av. 16 rdgs, mv. 17	540:460 av. 10 rdgs
Theoret:	
500:500	500:500
M.M. 120	140
509:491 av. 14 rdgs	515:485 av. 14 rdgs
Theoret.	
500:500	500:500

Subject W

Trochee, doublet ()

M.M. 40	80	100
512:488 av. 5 rdgs, mv 15	507:493, av. 8 rdgs, mv. 20	515:485, av. 14 rdgs
Theoret.		
500:500	500:500	500:500
M.M. 120	140	
504:496 av. 16 rdgs	529:471 av. 20 rdgs	

In all the trochees of Table VIII the accented note is lengthened. This lengthening of the accented note has been frequently reported. The doublet does not vary as much from the theoretical

value as does the iamb. The variation from tempo to tempo and from sitting to sitting is probably due to the amount of accent thrown on the first note of the doublet; it is well known that an increase in the accent increases the length of the accented note.

TABLE IX

Subject S

Dactyl, triplet ()

M.M.	40	80
	478:262:259 av. 7 rdgs, mv. 15	388:315:296 av. 7 rdgs, mv. 12
Theoret.	333:333:333	333:333:333
M.M.	100	120
	343:326:329 av. 7 rdgs, mv. 14	343:328:329 av. 7 rdgs, mv. 16
Theoret.	333:333:333	333:333:333
M.M.	140	
	345:334:321 av. 7 rdgs, mv 8	
Theoret.	333:333:333	

Subject W.

M.M.	40	80
	374:359:269 av. 4 rdgs, mv. 6	344:335:321 av. 7 rdgs, mv. 5
Theoret.	333:333:333	333:333:333
M.M.	100	120
	336:328:335 av. 5 rdgs, mv. 11	341:333:326 av. 14 rdgs, mv. 11
Theoret.	333:333:333	333:333:333
M.M.	140	
	352:318:330 av. 4 rdgs, mv. 12	
Theoret.	333:333:333	

Like the trochees, these dactyls of Table IX show the lengthening of the accented note. It is much more pronounced in some cases. The type is fairly well maintained in a given trial, as the mean variations show.

Discussion of Results

It is rare indeed that the actual temporal relations of a musical iamb of the dotted-eighth-sixteenth form correspond at any tempo to the "theoretical value" of the notation. Not only do the individual unit-groups differ from this theoretical ratio, but the averages do not vary about this ratio as a norm. Only six series, involving sixty-one readings, out of seventy one series, involving one thousand fifty-two readings, show values near the theoretical value. These series whose averages are near the supposed norm are not to be found at any particular tempo, nor with any particular subject; they are infrequent and accidental.

In general the unaccented note of the iamb is decidedly longer than the theoretical value at all tempos and with all subjects. The type of the unit-group at a given tempo for a given sitting is fairly constant, as the mean variations show; but the type varies widely not only from subject to subject and from tempo to tempo, but also from sitting to sitting at the same tempo with the same subject.

The records of triplets and doublets show the usual lengthening of the accented note, when compared with the theoretical value. In the case of the iamb however the "lengthening" of the short unaccented note cannot be attributed to accent.

The results tend to show that the groupings of the fundamental rhythmic unit-groups are not a matter of quantitative time division; the sense of rhythm cannot be explained in terms of judgment of time intervals. Professionally trained subjects are unable to achieve the theoretical ratios. The types are much too variable; with these six musicians the records show time divisions for the dotted-eighth-sixteenth unit-group which vary all the way from the theoretical ratio 1 :3 through 1 :2 to 2 :3 and there is no preference for some simple ratio.

On the other hand, the grouping is not the random placing of some short before a long so that "the 'attention' subordinates the minor to the major element." The small variations show a precise movement type for each sitting. Some process makes the division fairly exact for each sitting.

The conception of a rhythmic unit-group as an organized group of movements whose conditions are muscular comes nearer to fitting the facts. It is quite possible to establish a coördination involving particular muscles and a particular stress on the accented beat which shall give precise movements during a single sitting. Since the movements are precise their time intervals are also fixed and regular. Changes of stress and of muscle group alter the type of unit-group. The limits of the variation of short and long in the musical iamb are the limits of the possible coördinations which give a satisfactory grouping of a light short pulse and a following heavy pulse into a single movement cycle.

THE APPLICATION OF THE BINET-SIMON TESTS TO GROUPS OF WHITE AND COLORED SCHOOL CHILDREN*

George R. Wells

It has seemed to the writer that Oberlin offers a very fine opportunity to test the relative mental abilities of white and colored children. There is a fairly large number of colored children in the public schools of Oberlin, large enough to give some significance to a comparative test. The not unimportant part which Oberlin as a community and as a college has historically taken in the emancipation propaganda attracted many colored residents both before and after the war, a species of selection probably operating to choose the more intelligent and energetic members of the race. And the influences which attracted them were more or less effective to make the negroes welcome when they settled here, and to some extent, are still effective in the same way.

It has come about that at the present time colored residents are less set apart from white people than in most communities. The social environments of the two races are not as different as in practically all southern and most northern towns. The members of both races attend school, church and college on exactly the same terms. Of course this does not mean that the social environment of a colored family is identical with that of the average white family. But if the conditions for testing racial mental characteristics are not entirely free from the disturbances of environmental variations, they are perhaps as nearly free as we are apt to find anywhere in the country.

During the spring of 1914 an investigation was made of the relative mentality of the white and colored pupils in the public schools of Oberlin. In this investigation the writer was assisted by a group of his students from the Psychological Laboratory of

* The above article was written in 1915.

Oberlin College and by three members of the senior class of the Oberlin Kindergarten Training School, to all of whom acknowledgment is hereby made.

The tests applied were the ordinary Binet-Simon series. The form of test used was Huey's edition of Goddard's revision of the 1911 scale, as listed in the forms published by Warwick and York. The investigation was officially recognized by Superintendent Rawdon of the Oberlin Public School system. A room was placed at the disposal of the examiners at each of the three schools, and the pupils were sent from their class rooms to these examining rooms one by one. By this and other means it was possible to make the tests with very little distraction

Several problems of procedure arose early in the investigation. The period of testing covered several weeks, and, in spite of directions to the contrary, there is reason to believe that there was some little discussion of the tests among the pupils. There are two possible means of lessening, though not of eliminating, the effect of such discussion, assuming that it existed. In the first place, alternative questions could be, and were, used to some extent. But the limit of this method was soon reached. More to the point was the carefully carried out practice of having the tests on whites and blacks go on at the same time. White and colored children were examined in haphazard order. So that if any effect was produced by the conversation among the children concerning the tests there is no reason to suppose that it influenced one race more than another. The comparative value of the tests is certainly not affected by this influence.

Again it was found early in the tests that there was difficulty in the application of the fifteen year old test. For if a child passes the twelve year old test and fails in the fifteen year test there is some room for doubt as to how he should be classified. If there were thirteen or fourteen year tests the child might pass one or both of them. It is evident, I think, that mental age above twelve years can't be measured by the Binet-Simon scale. The following rules were adhered to in the calculation of the mental age after the tests has been administered.

1. All tests "over fifteen" were entirely neglected.

2. When the *mental age* of any child proved to be above twelve, no matter what his actual age, the card record of that case was discarded, and that record does not enter into the final results.

3. All cases of over twelve years *actual age* were likewise neglected unless the child failed in either the twelve year or in the eleven year tests.

4. If a child over twelve years actual age failed in the eleven or in the twelve year tests, the fifteen year tests were given. If successfully passed these counted as one additional year, or respective fraction thereof. But if the addition of this year made the mental age over twelve the card was thrown out as above stated.

5. No children under six years were included in the tests. The calculations of mental age were made by the writer and not in any case by the students engaged in making the tests.

Practically all white and colored children in the Oberlin Public Schools from six to twelve years of mental age were tested. The numbers actually recorded in the tables below, after eliminating all those affected by the rules just mentioned, were 96 negroes and 267 whites, the total number tested must have been half as many again.

In the following tables the figures represent percentages of the number of individuals involved, rather than actual numbers. This is done so that the difference in number of negroes and whites may be equalized. But for purposes of simplification one negro is counted as one percent of the total number of negroes instead of 1/96 of one percent, which is the strictly accurate figure. Likewise in the case of the whites concerned one case counts for 4/11 of one percent. As there are 267 whites concerned the absolutely correct figure would be 100/267 of one per cent, a rather unwieldly figure.

Table No. 1 shows the distribution of advancements and retardations for from six to twelve years mental age, with some cases running as high as sixteen years of actual age. The table

TABLE I

		6 Years W	6 Years N	7 Years W	7 Years N	8 Years W	8 Years N	9 Years W	9 Years N	10 Years W	10 Years N	11 Years W	11 Years N	12 Years W	12 Years N	13 Years W	13 Years N	14 Years W	14 Years N	15 Years W	15 Years N	16 Years W	16 Years N
ADVANCED	4			4/11																			
				4/11																			
								4/11															
	3			4/11		4/11																	
				4/11		4/11																	
				4/11		4/11																	
				8/11		8/11		8/11															
					1			8/11															
	2			1 9/11		4/11		1 1/11		4/11													
				1 1/11				1 1/11															
			1	4/11	1	1 9/11		1 5/11															
		4/11	1	4/11		1 1/11		8/11		[illegible]/11													
			1	8/11	1	4/11	1	2 2/11		1 1/11	1												
	1	1 5/11		8/11	1	4/11	1	4/11	1	4/11		4/11											
		1 5/11			2	4/11	2	1 1/11		2 6/11	1	8/11											
		8/11	1	8/11	1	4/11	4				1	1 9/11											
				1 5/11	4	1 9/11	2	4/11		1 5/11	3	2 10/11											
		4/11		1 1/11		8/11	2	1 1/11		4/11	1	2 2/11		4/11									
		8/11	1	1 5/11	1	4/11		8/11	2	1 1/11	2	1 9/11		1 9/11									
RETARDED				1 1/11	2	8/11	2		1	1 1/11	1	1 1/11	1	8/11	1								
					1	1 5/11		4/11		1 1/11	2	8/11		1 9/11	1								
					1	8/11		8/11	1	4/11	1	4/11	1	2 2/11									
						4/11	2	4/11						1 5/11									
	1			4/11		4/11	1	4/11		8/11					3	8/11							
								4/11		8/11					2	4/11	1						
										8/11				4/11	1	1 9/11							
						4/11				4/11	1	8/11	1	4/11	1	8/11		4/11					
								4/11		4/11			1		1	8/11		4/11					
	2								1			4/11		4/11		4/11	1	4/11					
														4/11		4/11	1	8/11					
															1	1 1/11	1	4/11					
																8/11		1 1/11	2				
												4/11						8/11	2				
	3													4/11				8/11	1				
												4/11				4/11		4/11	2		2		
																			1				
																			1	4/11	1		
																			1	4/11			
	4																1						
																		4/11		4/11	1		
																					1		
										4/11						4/11						4/11	
																					1	4/11	
	5																						
																					1		1

TABLE II

		6		7		8		9		10		11		12		13		14		15		16	
		W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N
RETARDED	3 to 4 years			$^{8}/_{11}$				$^{4}/_{11}$															
	2 to 3 years			$1^{9}/_{11}$	1	$1^{9}/_{11}$		$1^{5}/_{11}$															
	1 to 2 years	$^{4}/_{11}$	3	$4^{4}/_{11}$	2	$3^{7}/_{11}$	1	$6^{6}/_{11}$		$2^{2}/_{11}$	1												
	to 1 year	4	1	4	8	$3^{7}/_{11}$	11	$2^{10}/_{11}$	1	$4^{8}/_{11}$	6	8		$^{4}/_{11}$									
	Normal	$^{8}/_{11}$	1	$1^{5}/_{11}$	1	$^{4}/_{11}$		$^{8}/_{11}$	2	$1^{1}/_{11}$	2	$1^{9}/_{11}$		$1^{9}/_{11}$									
ADVANCED	to 1 year			$1^{5}/_{11}$	4	$3^{7}/_{11}$	5	$1^{9}/_{11}$	2	$3^{3}/_{11}$	4	$2^{2}/_{11}$	2	$6^{2}/_{11}$	5	$^{8}/_{11}$							
	1 to 2 years					$^{4}/_{11}$		$^{8}/_{11}$	1	$2^{2}/_{11}$	1	$1^{1}/_{11}$	2	$1^{1}/_{11}$	5	4	2	$1^{1}/_{11}$					
	2 to 3 years											$^{8}/_{11}$		$^{8}/_{11}$	1	$2^{2}/_{11}$	2	$3^{7}/_{11}$	5				
	3 to 4 years											$^{4}/_{11}$				$^{4}/_{11}$	1	$^{4}/_{11}$	5	$^{8}/_{11}$	3		
	4 to 5 years									$^{4}/_{11}$						$^{4}/_{11}$		$^{4}/_{11}$		$^{4}/_{11}$	3	$^{8}/_{11}$	
	5 to 6 years																				1		1

TABLE III

	6		7		8		9		10		11		12		13		14		15		16	
	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N
Advanced	$4^{4}/_{11}$	4	$10^{10}/_{11}$	11	$9^{1}/_{11}$	12	$11^{8}/_{11}$	1	$6^{10}/_{11}$	7	8		$^{4}/_{11}$									
Normal	$^{8}/_{11}$	1	$1^{5}/_{11}$	1	$^{4}/_{11}$		$^{8}/_{11}$	2	$1^{1}/_{11}$	2	$1^{9}/_{11}$		$1^{9}/_{11}$									
Retarded			$1^{5}/_{11}$	4	4	5	$2^{6}/_{11}$	3	$5^{9}/_{11}$	5	$4^{4}/_{11}$	4	8	11	$7^{7}/_{11}$	5	$5^{5}/_{11}$	10	$1^{1}/_{11}$	7	$^{8}/_{11}$	1

TABLE IV

	6		7		8		9		10		11		12		13		14		15		16	
	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N	W	N
Advancement Units	13	7(19)	58	15(41)	45	13(36)	60	1 (3)	25	8(22)	22		1									
Retardation Units			4	4(11)	12	5(14)	9	4(11)	26	6(16)	22	6(16)	29	18(49)	51	14(38)	45	35(96)	13	33(91)	10	6(16)

shows advancements and retardations in terms of 1/5 years, after the familiar Binet-Simon method.

Table No. 2 is inserted for purposes of convenience to provide a summary of Table 1. The figures are the same as in the first table except that they are for years, instead of for fifths of years.

Table No. 3 is a summary of the total percentages retarded, advanced and normal for both races. Inasmuch as only those were counted normal who were exactly at the age level to the fifth of a year, the number seems small. The reckoning of the actual age of the children in fifths of a year was done easily and accurately by consulting the school records of the date of birth.

A view of the final results is given in Table No. 4, which is so arranged that at a glance one may observe the relative results from the two races, without being confused by the fact that there were about two and a half times as many whites as negroes concerned in the tests. Also the total amount of retardation is indicated, as well as the number retarded. These are two different things, for while one race might have more actual cases of retardation than the other, in the case of the second race the degree of retardation in the cases of those who were backward might be comparatively very high. Therefore the Table is an arrangement of what may be called "retardation units." A "retardation unit" may be considered as one case retarded for one year or for part of one year. Thus the retardation of a child three years behind his age level would be recorded as three units. "Advancement units" are reckoned in a similar way. The figures which give the units of retardation and advancement for the negroes are followed by other figures in brackets. These bracketed figures are the numbers of units earned by the negroes multiplied by 11/4. The figures thus obtained are directly comparable with the number of units earned by the whites, and enables the reader easily to compare the performances of the two races.

If these results are carefully examined it will be seen that the whites make, in the whole, a little the better showing. The great-

est advancement reckoned in terms of averages is white, and the individuals which were most advanced were white. On the other hand the greatest retardation in point of averages, and the most retarded individuals were negroes. The arrangement in terms of retardation units is still more strongly indicative of an advantage on the part of the whites. The total number of retardation units on the part of the whites is 221, and on the part of the negroes is 358. The advancement units for the whites number 224, and for the blacks 121. In both of these cases the figures given for the negroes is that obtained by the equalization process of multiplying the actual number of negro units by 11/4. Judging by any of these Tables there is a small but not insignificant advantage in favor of the whites.

But far more important than the mere fact of a better showing made by one of the racial groups is the arrangement of the results as regards ages. It is very noticeable that the negroes are at least equal to the whites at the ages of six, seven, and eight. Nor are the negroes very markedly inferior to the whites at the ages of nine, ten and eleven. At twelve years there is a marked difference, and it becomes progressively more marked from twelve to sixteen, reaching its climax at fourteen and fifteen. Evidently the children start in on equal terms, and maintain that equality for some years. But gradually the negroes lag behind, and at about the age of finishing grammar school or entering high school seem to be definitely inferior to the whites. There are, of course, many exceptions. These results are to be understood as averages of performances of a moderately large number of school children. Their significance must not be mistaken nor exaggerated. But it seems to be beyond doubt that under the conditions mentioned, and using the tests which we used there is no difference in the reactions of white and colored children up to the age of ten or eleven. At the age of twelve a difference is noticeable, which difference becomes very prominent at fourteen, fifteen and sixteen years of age. That the negroes are outstripped seems undeniable.

It remains to determine the cause of this difference. The simplest explanation and that which comes first to one is that

it is a manifestation of some inherent mental superiority of the white race over the negro. But it seems evident to the writer that such an explanation can not be applied in this specific case. One reason will sufficiently dispose of it, and that is the impossibility of determining the purity of blood of many negroes. Beyond all doubt most, if not all, of the colored children examined have some mixture of white blood, in proportions impossible to determine.

The correct explanation will probably be found when the social conditions and limitations of the two races are examined. Mr. Howard L. Rawdon, the Superintendent of the Oberlin School System, has gone into the question of the social differences confronting the two races in a report presented to the Department of Education of Oberlin College and entitled "The Colored Pupil in the Oberlin Public Schools." He points out that the limitation of possible professions for negroes is so great that there is smaller incentive to continue at school than operates in the case of the white children. He also shows that the economic position of the negroes in Oberlin is not good. The colored people constituted something more than 18% of the population of Oberlin in 1913, but owned no more than 4% of the taxable property. And what is still more significant is the fact that less than 7/10 of one percent of the personal property is owned by negroes. The percapita wealth of the whites is more than five times that of the colored people. Further, records of crime in Oberlin show that the colored people are responsible for far more than their share, calculated on their proportion of population. And this criminal tendency becomes even more marked if serious crimes only be considered, and mere violations of local ordinances be neglected.

The social and moral conditions so briefly mentioned above may properly be held responsible for the very great irregularity of school attendance and for the large amount of tardiness in the case of negro children in general. Mr. Rawdon states that the school records show that the colored pupils are absent practically fifty percent more than the white pupils, and that the boys

are absent oftener than the girls, the reverse of the case with the whites. It is also very significant that the colored pupils drop out of school much earlier than do the whites. For instance, in the four lower grades 27.4 % of the enrollment is colored; in the four upper grades, 21.8% and in the High School but 10.3 % are colored. No doubt much of this absence and early leaving of school is due to economic pressure driving the children to work, much of it is also due to the generally unpromising outlook for the colored student, even if he does graduate from High School. And to this latter cause and the unambitious attitude it engenders is due the excessive amount of tardiness, which Mr. Rawdon also notes.

The writer feels that the probability is that the disparity in performance between the groups of white and colored children which he and his assistants tested is due to social and environmental factors rather than to inherited or racial traits of mental ability.

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Certain Factors in the Development of a New Spatial Co-ordination

BY

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CONTENTS

I

INTRODUCTION

The purpose of this investigation was to determine experimentally the relative influence of various sensory modes of reaction, as sight, touch, and hearing, in the building up of a new space habit. This particular habit was developed by the subjects in the process of learning to localize correctly objects seen through prismatic glasses which distorted the visual field.

The perception of space is, to a greater or less extent, the product of individual experience. The adult is able to adjust himself spatially to the outer world only by virtue of the possession of a system of complex habits of reaction. These habits have been slowly and painfully acquired, most of them in infancy. But the process of acquisition as it occurs in infancy is forgotten, and later changes in space reactions come so gradually that the details of the adjustment are not noticed. The adult learns to find a new keyhole in the dark in much the same way that the child learns to pick up his rattle. Hence it is easy to overlook the fact that every move we make depends for its nicety and accuracy upon the unified functioning of an exceedingly intricate reaction system—a system in the building up of which countless simple reactions have played a part.

It would be of great importance for psychological theory to determine the mechanisms underlying the development of this complex system of adjustments. Does the development take place on a purely sensory-motor level, or is it influenced by ideational factors? Is actual movement in space essential, or could a passive subject gain effective perception of a spatial situation? Do all normal individuals develop spatial habits in the same way, or are there individual differences in the matter?

The chief problem discussed in the theoretical literature on the genesis of psychological space so far has concerned the relative importance of various sensory factors. Taste and smell

and the organic and cutaneous modes of activity other than contact, are by common consent held to be of negligible importance in this connection, in spite of the contention of James that all sensations possess original spatial quality. The status of hearing is in dispute. In general, psychologists are inclined to assign it little if any importance as a spatial sense. Contact, however, has been considered to be highly important as a factor in space perception, this attitude being correlative with the popular notion that touching an object is the final test of its real existence. To others vision has seemed the spatial sense preeminent. Vision and touch, it is held by some, are the only senses that "possess real spatial character," and other senses, such as kinaesthesis, become important in space experience only by virtue of their connection with these.

While an enormous quantity of experimental work has been produced bearing on the spatial aspects of the various senses taken in isolation, almost nothing has been done by way of investigating experimentally the relative influence of the various sensory factors as they coöperate in the development of complex types of spatial reaction. Speculation has been supplemented, it is true, by observations on the behavior of young children and of animals; on the reported experiences of congenitally blind persons restored to sight; and on certain cases of alleged abnormalities in the space reactions of adult individuals. But not only has none of the data so adduced as evidence been gathered and presented in a scientifically systematic way, but it does not seem likely that in such fields of observation enough experimental control can ever be introduced to insure validity for the conclusions drawn.

It is possible, however, to demonstrate conclusively, by experimental procedure, certain central facts about the manner in which spatial coördinations *may* develop. If we cannot get at the actual initial processes in the development of the complex world of space for any individual, we can at least investigate experimentally the building up of certain spatial coördinations, by observing what happens when an individual readjusts himself to space relations that have been artificially disturbed. The ex-

perience of people who have gradually become used to a new pair of glasses which alters in any noticeable way the field of vision, offers an illustration of the fact that it is possible through practical experience to readjust one's ordinary coördinations in such a way as to harmonize again disturbed spatial relations.

Strangely enough it was not until comparatively recent years that the idea of investigating the development of spatial organization by producing and then overcoming an artificial disorganization, was conceived and carried out. In 1897 Professor George M. Stratton published his celebrated paper on "Vision without Inversion." The immediate purpose of the experiments reported in that article was to prove that inversion of the retinal image is not a necessary condition of upright vision. They furnished also, however, a striking demonstration of the predominantly empirical character of spatial organization. Incidentally they threw some light on our particular problem of the relative efficacy of various concrete factors in adjustment.

Stratton, it will be recalled, in his main experiment adopted the plan of wearing glasses constructed from lenses which completely reversed the retinal image, and hence directions in the field of vision, so that objects formerly appearing to the right now appeared to the left, and objects formerly in the upper part of the field of vision now looked to be in the lower part. In other words, on first assuming the glasses the entire visual scene appeared to be upside down. Stratton wore these glasses continously for eight days, except during hours for sleeping, when he was carefully blindfolded. He went about his ordinary activities somewhat as usual. He found that not only was he able gradually to make effective practical adjustment to the changed visual situation, but that at the same time the new arrangement came to seem more and more natural to him, until at the end of eight days things no longer appeared to be upside down. A new visual system had even in that short time been more or less completely organized, and harmonized with sense impressions from different fields to such an extent that his space world was again unitary.

This experiment of Stratton's demonstrated first that the inversion of the retinal image is not a necessary condition of normal

vision, the fact which he originally set out to prove. It showed, second, that it is possible in the give and take of ordinary experience to build up an entirely new spatial organization in which various sensory factors come to be associated together in new ways.

In addition to establishing these general facts, Stratton made valuable observations on the role played by various factors contributing to the process of readjustment. It was his main purpose, however, to establish the general fact that harmonious readjustment can occur, rather than to study the specific factors concerned in the process. He made no effort, therefore, during the course of the experiment systematically to investigate the formation of any one coördination, but merely noted down, as the experiment progressed, those observations which seemed to him pertinent. These observations constitute a valuable contribution to the factual study of the more general aspects of space perception, but additional data of a specific and quantitative nature are needed as a basis for more detailed conclusions. In fact it would take the combined results of many individuals to warrant the drawing of such general conclusions.

It is the aim of the present work, then, to contribute something toward the experimental investigation of those factors in the development of space perception which Stratton treated only incidentally. We know now, through his experiment, that disturbed space relations can be effectively reorganized in experience. The next step is to determine how such a reorganization is effected—what factors coöperate, what their relative influence is, and what their mode of functioning.

II

APPARATUS AND METHOD

Stratton's method, while admirable for his purpose, is far too complex for ours, and would involve too much fatigue and inconvenience to be employed with any considerable number of subjects. The essential nature of the process in question would be the same were the observers to be subject to the disturbed con-

ditions for only a short time each day, instead of continuously. If under such circumstances reorganization could be secured at all, it would permit of definite experimental control and would yield results just as significant for the general theory of space perception as would those obtained in more complex situations, in which exact control would be almost impossible.

We finally determined to use, instead of Stratton's 180 degree reversing lenses, a pair of prismatic glasses which produced an angular deviation of the visual field of about 21 degrees. These the subjects wore for 20 minutes each day, while working at the simple task of localizing, by reaching movements, objects arranged in definite positions. We found that under these circumstances there was a gradual and progressive tendency, more or less completely fulfilled according to experimental conditions, to overcome the wide initial visual distortion and to localize the objects more and more accurately. We then planned a series of experiments with the object of determining first, what are the sensory or other factors concerned in this particular process of readjustment; and second, what is the relative efficacy of the different factors involved.

The glasses used in our experiment consist of two 40 degree optical prisms producing an angular deviation of about 21 degrees. These were mounted in a light aluminum frame in such a way that they can be easily adjusted back and forth; or turned in any one of the four directions—right, left, up, or down. The prism used for the left eye consists of two 20 degree prisms combined, and produces a deviation slightly greater than the prism for the right eye, but not great enough to cause any trouble in combining the images for the two eyes. Throughout the experiments we were thus able to work with binocular vision, in which respect our conditions are superior to those of Stratton, who relied on monocular vision.

Careful measures were taken to insure that no light should enter the eyes of our subjects except that which came through the prisms. The light frame in which the prisms are mounted, is so shaped as to fit closely over the nose. To the upper and lower

sides are glued fitted pieces of black cloth-covered felt about a fourth of an inch thick, so shaped as to extend back and rest against the forehead and cheeks. To the ends of the frame are attached double flaps of black cloth which extend back toward the ears. The glasses were kept in place by an adjustable rubber band extending from the ends of the frame around the back of the subject's head. When they were put on, a piece of cotton was slipped under the lower part of the frame, over the cheeks and nose, in such a way as to fill up any space that might remain. Thus only light that came through the prisms was admitted to the eye.

At first subjects usually felt somewhat disturbed, on account of the strangeness of the prismatic effect, and the unusual limitation of the visual field by the frame of the glasses. But this feeling soon wore off, and after two or three sittings they reported feeling quite natural and at ease. The glasses are fairly light and not uncomfortable. It is easy to obtain a relatively clear single image of any object by turning the head in the proper direction.

While wearing these glasses the subject was set to work at a task offering favorable conditions for the formation of a new spatial coördination. He was seated at a table facing a row of objects which he was to localize by reaching out with his right arm and right index finger. (See Plate I.) These objects, small electric buzzers (C), are suspended at about the level of the subject's eyes from a horizontal iron rod (R) elevated 35 cm. above the top of the table. The rod is held in place by three wooden uprights fastened to a board at the back of the table which joins two other boards at the ends (G, G) to form a box-like upper extension of the table, open in front.

Now with the prisms adjusted to cause a deviation to the right, a buzzer which was really directly in front of the subject appeared to be about 25 cm. to his right, and in pointing it out he touched a point 25 cm. farther to the right than the buzzer actually was, there being no incentive to correct to the left. In order that the subject might not see his arm when reaching for the buzzers, and thus be tempted to correct the obvious error, a wooden cover was provided for the box-like extension, attached at the

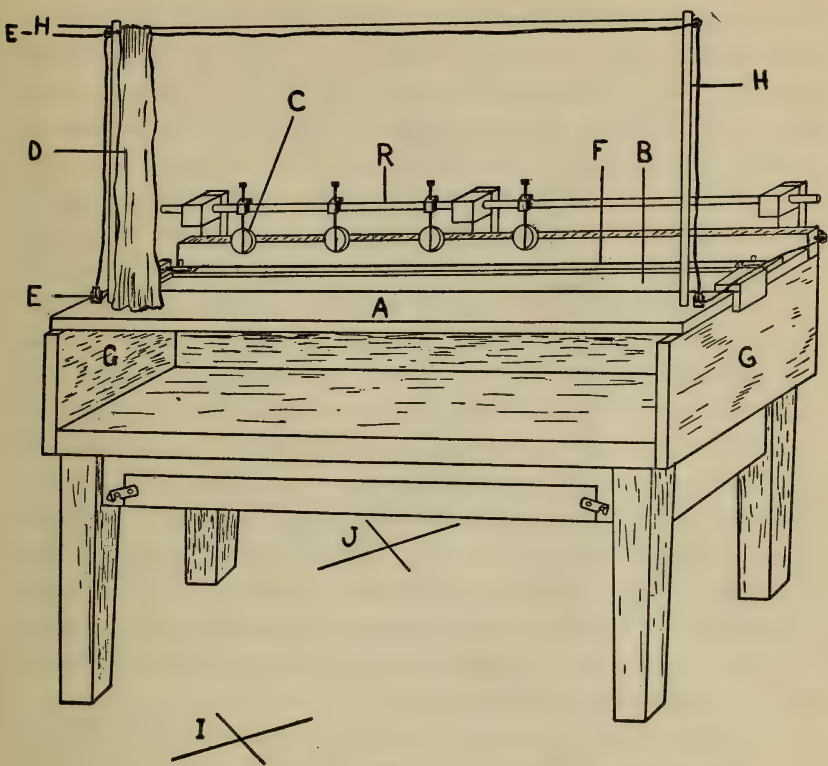

PLATE I

ends to the top of the end boards (G, G). The subject, seated in the chair with base at I, thus looked *over* the cover at the objects (C) but localized them by reaching out his arm *under* the cover. When leaning back in the chair between trials, the subject was prevented from seeing his body by the frame of the glasses. Hence at no time while wearing the glasses was any part of the subject's body visible to him.

In certain of the series it was necessary that the position of the subject's finger be observable by the experimenter, seated back of the apparatus, while not by the subject himself. Therefore just beneath the buzzers there is a narrow slit, between the cover and the back of the extension, through which the experimenter could look down and note the position of the sub-

ject's finger. It was necessary also that this slit be widened at times in order that the subject might at the end of his reaching movement see his finger and thus note his error; or in order that the buzzer might be lowered down through the slit in such a position that the upper half would be visible to the subject, and the lower half, although beneath the cover and invisible, could be touched by the subject as he reached out. To provide for the three different widths of the slit thus necessary, the back part of the cover is made adjustable, or capable of being moved from back to front and vice versa, to widen or narrow the slit. It is desirable that this movable part of the cover have a thin edge and a smooth under surface furnishing no tactual clues of position, and so it is made of a strip of glass about 18 cm. wide, with the upper surface painted black. This strip (B) is set in a sliding wooden frame which can be pushed part way back under the front or wooden part of the cover (A). The distances by which this adjustable strip in its frame shall be moved to front or back is regulated by means of brass stops at the ends of the frame. In this way the strip can easily be set for any one of the three different widths of the slit desired.

The position of the buzzers along the rod and their height above the table can be easily changed. The detail diagram (Plate II) shows how this can be done. Each buzzer is clamped to the lower end of a long screw. To this screw is attached a brass clamp through which the buzzer can be adjusted up and down. The clamp fits over the iron rod and can be securely attached to it at any position by means of a small thumbscrew at the back. The buzzer can thus be raised (after loosening the thumb screw and the small nut) by lifting the clamp off the rod, and setting it toward the bottom of the screw. It can be lowered by setting the clamp toward the top of the screw. The clamp can be put in the same position on the rod, or in another position, and screwed in place as before. In the figure one buzzer is shown raised and another lowered half way through the slit. In actual practice all the buzzers are at the same height in the same experiment.

The buzzers are connected with two dry cell batteries kept in a box attached to the back of the apparatus. They are operated

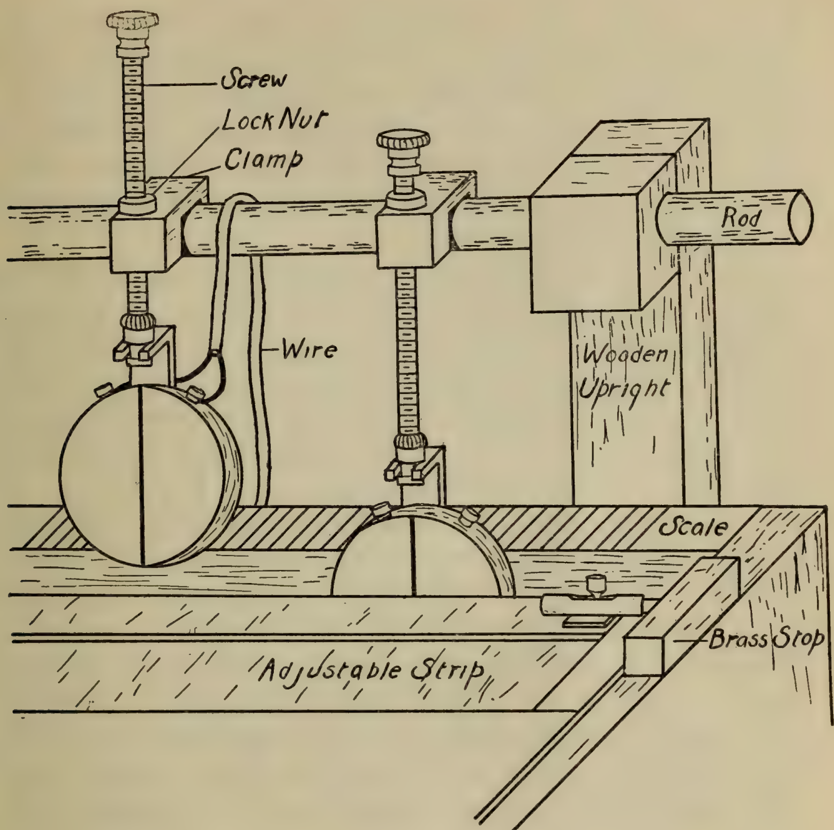

PLATE II

by means of a row of push buttons arranged near the battery box. The light flexible wires from the buzzers hang inconspicuously down over the rod at the back. Also at the back of the table, to the experimenter's right, is a shelf for her use in recording data, and to her left a small shelf for extra buzzers. None of these parts of the apparatus are in view of the subject.

In most of the experimental series it was necessary that the subject should not be able to perceive the extent and direction of his error by noting the position of the experimenter's head when she bent over to get the record. To prevent this, two different methods were used. At first the subject was merely asked to close

his eyes as soon as the localization was made. This proving unsatisfactory, a black curtain (D, Plate I) was arranged to shut off the view of the buzzers after each localization. It operates between two vertical iron rods (H, H) by means of a system of rings, screw pulleys (E, E), and cords, which enable the experimenter to manipulate the curtain easily and quickly by the use of one hand behind the apparatus.

The chair in which the subject was seated is a small armless swivel chair of adjustable height, easily rotated. It was kept in the same position throughout the sittings, 15 cm. in front of the line connecting the front legs of the table, the center of it 12 cm. to the left of the mid-point of that line. The experimenter sat on a high office stool back of the apparatus and just opposite the subject. (Base of stool shown at J.)

A few minor points will complete the description of the apparatus. The iron rod is covered with rubber tubing to prevent jarring and modification of the sound of the buzzers. Just back of the board which forms the back of the extension, is painted a centimeter scale (reading from right to left from the subject's point of view) on which the position of the subject's finger at any localization can be read off by the experimenter. A vertical black line painted on the front face of each buzzer makes it more easily localizable. The whole apparatus with the exception of the buzzers is painted a dull black, the lines of the scale being marked in white.

The dimensions of the chief parts of the apparatus not already given are as follows: top, 60.5 cm. by 121 cm.; height, 78 cm.; height of cover above table, 27.5 cm.; diameters of buzzers, 4.5 cm.

The general order of procedure in the experiments was about as follows. On the first day the subject was given a preliminary test for accuracy of normal localization of the buzzers by hand movement, without the glasses. On the second day he wore the glasses, and was instructed to localize the buzzers in the same manner as at the first sitting, *as they appeared to him,* disregarding the fact of distortion. Under these conditions it was found that the subjects, influenced consciously or unconsciously by certain sen-

sory or other factors, showed in succeeding sittings a tendency to approach closer and closer to the actual or normal standard of localization. For instance in the first day's sitting with distorted vision subject R. reacted on the average 18 cm. to the right of the actual position of a buzzer; in the second day's sitting the average distance from the true position was only 16.5 cm.; in the third, only 14.5 cm., the fourth 12 cm., and so on.

The original aim of the experiments was to continue the sittings for each subject either until he had completely "overcome the effects of the distortion", as happened in many cases; or until he had reached the limit of improvement. Since it was impossible for many of the subjects to continue with the sittings until such a limit had been reached, the latter requirement had to be given up. But all the subjects whose results are considered in the group comparisons either "overcame the effects of the distortion" in less than 10 sittings, or continued until 10 sittings with distorted vision had been taken.

The time of day for the sittings was kept constant for each subject as nearly as possible, and was very rarely changed. In general each subject took one sitting a day, six days a week, although occasionally it was necessary to omit two days out of the seven. Each sitting lasted exactly 20 minutes. In that time 20 localizations were made, five for each of four different positions of the buzzers along the scale, the interval between the "localizations" or trials being 60 seconds throughout all the experiments. Such a long interval was made necessary by the circumstance that in certain of the series adjustments of the apparatus which required that much time had to be made in the interval.

During the interval conversation between the subject and experimenter was permitted and in fact encouraged, first that the subject might feel at ease and natural, and second that he might get the habit of making his localizations in an unstudied and automatic manner just as he would reach out for an object under the conditions of everyday life. The effort was made to get each subject to give himself up freely to the conditions of the experiment. The directions called for a disregard of the fact of

distortion, and required the subject to react, although carefully, without self-consciousness or critical analysis of the nature of the localizing movement or of the possible error. Introspective comments were not asked for until after the final sitting, but remarks made spontaneously were carefully noted during the series; and if a peculiar tendency in the results developed at any time a question was put by the experimenter relative to the subject's attitude or understanding of the directions. Unusual bodily conditions—of extreme fatigue, excitement, etc.—were reported and recorded by the experimenter.

In all 72 subjects were used in the main experiments—five being Instructors in the Department of Psychology of the University of Chicago, 40 graduate students in the University (most of these in the Department of Psychology) and 27 upperclassmen taking a course in psychology. The writer conducted all of the experiments in person, except that at two different times of emergency fellow graduate students, Miss Dorritt Stumberg and Miss Katherine Ludgate, very kindly helped out by each giving three or four sittings to two subjects already started in a series. The writer herself acted as subject in all the experimental series possible, WHILE others acting as experimenter, and with conditions as nearly like those for the other subjects as could be arranged. In this way she took series A-1, B-1, C-2, and D.

The experiments here discussed extended over a period of about 12 months.

III

DESCRIPTION OF EXPERIMENTAL SERIES AND RESULTS

There has been much disagreement concerning the relative efficacy of the various modes of sensory reaction in the development of space habits. Particularly has this been the case with respect to sight and touch (including kinaesthesis). Whether or not hearing is a "spatial sense," or may contribute anything to the development of an organized system of spatial reactions, is also a much disputed question. Taste and smell are almost

universally held to be of negligible significance in this respect. Our investigation, therefore, has to do with the relative efficacy of hearing, sight, and touch, as factors contributing to the formation of the new spatial coördination developing under the conditions of our experiment.

There were five main series of experiments. The first (A) was given as a standard series for purposes of comparison with later series. Records were secured from a group of subjects showing their manner of localization of the buzzers from day to day, with distorted vision, but without the sensory clues the influence of which was later to be tested. For this series the slit at the back of the cover was so narrowed that the subject could not see his finger after reacting, nor touch the buzzer. The buzzer was not sounded as the signal for reaction, but merely pointed out by finger movement.

In the second series (B), designed to test the efficacy of sound, conditions were exactly as in the first except that the buzzer was sounding. In the third series (C), to test the efficacy of touch, the buzzer was lowered half way down through the slit so that when a correct localization occurred there would be contact of the finger with the buzzer. In the fourth series (D), to test the efficacy of sight of the localizing finger, the slit was widened so that the finger tip could be seen after the localization had been made, and the buzzer was raised high enough to prevent contact. In the fifth series (E), designed to test the influence of tactual-kinaesthetic sensations from the left arm, no buzzers were used. The subject extended his left arm *over* the cover, bending the index finger down through the slit, and localized this finger as the buzzer was localized in preceding series, by a reaching movement of the right arm under the cover.

STANDARD SERIES

1. Effect of Knowledge of Experimental Conditions

a. *Experiments With Knowledge*

For the standard series, four buzzers were set along the rod at the positions 53, 66, 79, and 92 on the scale. The total length

of the scale being 20 cm., this means that they were set toward the left end, in such a position that they were directly in front of the subject. Distorted, they appeared shifted about 25 cm. farther to his right. On the first day the subject was given 10 trials for normal accuracy of localization of the buzzers, without the glasses. At the second sitting he began the series with distorted vision. The experimenter first instructed the subject as to the proper position of the chair, and then placed his right arm in front of him more or less parallel to the edge of the table. She told him that at the signal "Ready" he was to assume this position, but not to feel that the position was to be rigidly defined—that the only object was to get a uniformly free sweep of the arm. The subject was told also that he would work in ignorance of the purpose of the experiment, and was cautioned not to talk to other subjects who had finished, about that purpose. Then he was given the following instructions, typewritten, and asked to study them carefully:

"When I point out one of these four buzzers by placing my finger on it, localize it as in preceding series without the glasses by a direct movement of the right index finger to the point just below the midpoint of the buzzer indicated. The glasses will give a distorted view of the buzzers, but pay no attention to this fact in making your localizations, simply taking pains to localize the buzzer as accurately as possible *as it appears to you*. You will have no means of judging the accuracy of your localizations, so pay no attention to the possible nature of errors, but reach out directly to the buzzer, in a natural and automatic manner, concentrating your attention on the sight of the buzzer. In making the localizing movement, move your head and body freely, as you choose.

"When you have touched the board, close your eyes and keep your finger in place until I say 'All right.' Then relax in your chair and open your eyes if you wish. When I say 'Ready' assume your former position with your arm in place ready to react as before. There will be one trial every 60 seconds, and the stimuli will be given in irregular order. You may converse on indifferent topics between trials, but at the signal "Ready", which will be

given two seconds before the stimulus, all conversation will cease."

After the subject had read these instructions the glasses were put on him by the experimenter and he swung around in the chair, facing the buzzers. The point is to be emphasized that the subject, in making his localizations, had no direct sensory means of judging their accuracy. The buzzers were not sounding. The slit was so narrowed that the subject could not see his finger when he had made a localization. In order that he might not gain knowledge concerning the direction and extent of his error through noticing the position of the experimenter's head when she bent over to take the record, the instructions are explicit that the subject shall close his eyes as soon as he has touched the board, and not open them until she says "All right" which means that the position of the finger has been noted and that the experimenter has assumed her usual position again. Great care was taken in regard to this point.

While the subject was not told what was the direction of the deviation, in most cases he found it out during the first sitting, being familiar with the normal appearance of the apparatus and knowing how the prisms were set in the glasses. But there were no clues to enable him to realize the extent of his error from day to day. The fact that there was no such realization, is proved by the comments of the subjects, who confessed themselves in the dark and frequently made absurd estimations of the amount of their errors. But this group did work, it must be noted, with some knowledge of the experimental conditions.

The results of this first series with distorted vision are surprising. They indicate that there is from the first localization, a progressive tendency on the part of most subjects gradually to approach the actual position of the buzzer. In general the rate of readjustment is slow. Of the initial linear deviation, which in this group averages for the four buzzers 21.1 cm., only 40.5 per cent on the average was recovered in the first 10 days. However for the six subjects in the group who were kept at the task until the limit of improvement was apparently reached (until at least five sittings in succession showed no improvement) the total percentage of readjustment amounted to 59 per cent over

the initial deviation. This means that in spite of the fact that these subjects had no sensory clues as to the actual position of the buzzers, they still "readjusted" to the new visual situation, to the extent that they learned to localize the buzzers at a point about 60 per cent nearer their actual position than they had localized them at the beginning of the series. In other words we have an ascending curve instead of the straight line that might have been expected.

A glance at Figure I, showing graphically the results of subject H. R. K., which are typical for the first group of experiments, will make the situation clear. The numbers on the ordinate refer to positions on the scale in centimeters, and those on the abscissa to successive days' sittings. The four straight lines at 53, 66, 79, and 92 represent the actual positions of the 4 buzzers. Buzzer number 1 (53) is to the subject's right; buzzer number 4 (92) to his left as he sits at the apparatus. The curves which approach the lines show the progress of the subject from day to day, each point on a curve representing the average of the five trials for that buzzer taken on that day. The line and curve for buzzers 92 (4) and 66 (2) are dotted, while those for 79 (3) and 53 (1) are unbroken.

In seeking for a method of treatment of the results which should be suitable for all the series of experiments in our investigation, we finally decided on the following plan. The measure of the amount of readjustment effected in any case is the distance in centimeters still "unrecovered" when the subject has reached his highest point of readjustment. In the case of any subject, then, this distance will be obtained for each buzzer by substracting the average of the five localizations made at the highest point of readjustment, from the average of the five trials for normal visual accuracy made for the same buzzer. This will give the number of centimeters that would have to be "recovered" before the subject would again attain his normal accuracy in localizing the buzzer. Such a linear distance yet remaining to be "recovered" we will call arbitrarily in our discussion of results, "the remainder." For example subject H. R. K., beginning with a linear deviation of about 25 cm. for buzzer number 1, had reached as her high point of readjust-

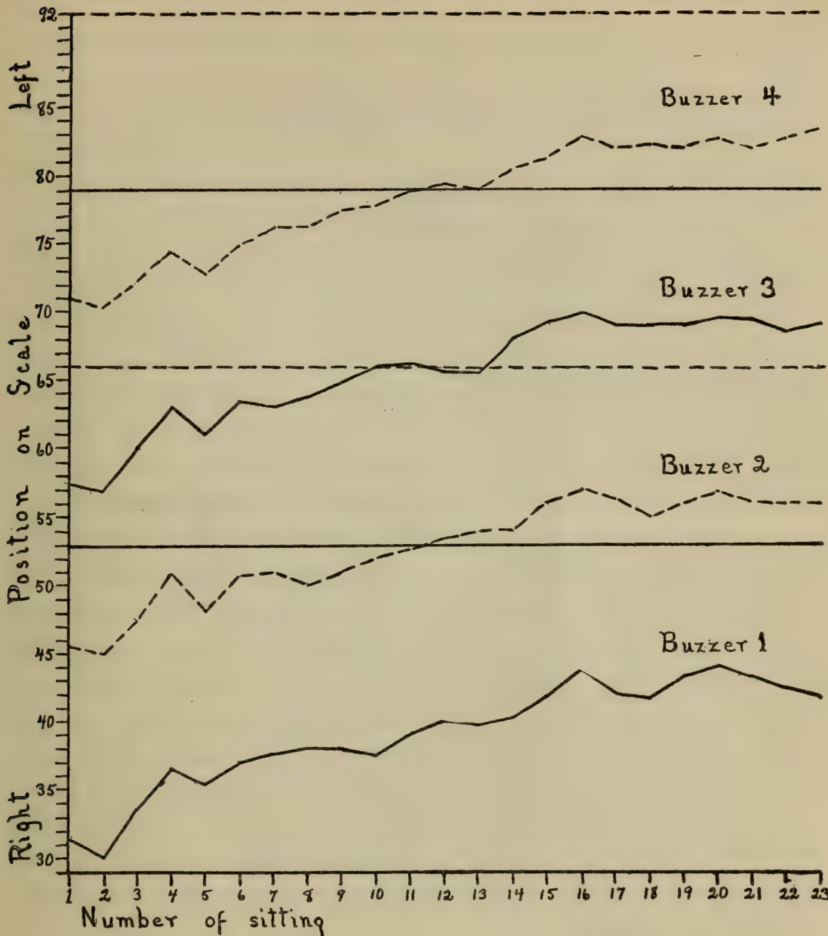

FIG I. Readjustment of Subject H. R. K. Standard Series

ment for that position, on the 19th day's sitting, the average position of 44.5 cm. Her average normal localization for buzzer 1 is 55.5 cm. Her remainder for buzzer 1, then, for the whole period of the series, is 55.5 cm. minus 44.5 cm., or 11 cm.

In addition to thus measuring the amount of readjustment by the remainder, or remaining distance from the normal standard of accuracy, it is also convenient at times to use as a measure the per cent of the linear deviation which has already been recovered. Such a measure is, however, far less significant for comparative discussion than the remainder, for the reason that it is based on

the initial linear deviation, which varies greatly among individuals.

While theoretically the glasses should produce a standard objective linear deviation which is the same for all individuals, practically, under the conditions of our experiment, they do not. This is because in the first place the position of the head is not constant, and the linear deviation varies somewhat with every change in the distance from the buzzer to the eye, and in the angle formed by this line with the scale at the back of the apparatus along which the linear deviation is measured. It was not possible to keep these factors constant by fixing the head position, because among the series is one involving auditory localization, for which free head movement is essential; and general conditions had to be constant throughout the experimental series.

A second reason for individual variation in linear deviation may be found in the variability of the angle of incidence or the angle at which the rays of light from the buzzer strike the prisms. According as the buzzer is viewed through the large or the small end of the prisms, there is a difference of several centimeters in linear deviation. As a matter of fact with the direct forward fixation which was naturally maintained in localizing the buzzers the change due to variation in angle of incidence would be so slight as to be practically negligible. It must be reckoned with, however, as a factor tending to produce a slight amount of variation from individual to individual as well as within the results of any one subject.

Thus it is impossible to determine a standard general linear deviation upon which to base per cents of readjustment for all subjects. It might seem practicable to base the per cents of readjustments for an individual on his own initial linear deviation. But it is not possible closely to determine even this individual deviation. Several trials would be needed for a reliable determination. Readjustment, however, begins after the very first trial, and indeed in some series even prior to it. Again, the head position even of one individual, may change somewhat from trial to trial for the same buzzer.

It is clear, then, that for purposes of group comparison the

remainder, rather than the per cent of readjustment, is the more reliable measure of progress. It will be helpful, however, to deal with per cents in treating individual results, and in broad general discussions.

To find the per cent of readjustment for any individual we must find the total distance between the *initial* localization with the glasses and the place of normal localization, and determine what per cent of that distance has been recovered at the highest point of readjustment. In the first two series, A and B, the five localizations of a buzzer in the first sitting are about the same, and so to find the initial deviation for individuals in those series we will subtract the *average* of the first five trials for a given buzzer, from the average of the 10 trials for *normal* accuracy of localization of the same buzzer.

In series C, D, and E, however, readjustment is so rapid that the average for the first five trials for a position would already represent an advance of as much as several centimeters over the initial localization for that position. Hence in these later groups we are compelled to find the initial deviation for a given position by subtracting the first trial only from the average normal localization. This will mean greater variability in linear deviations, since one trial is not a sufficient measure of accuracy. Here too there will be considerable variability in the amount of initial deviation for the four different positions, owing to the fact that readjustment is already in progress after the first localization among these four. For the last three series, then (C, D, and E), since the per cent of readjustment based on initial deviation will be particularly variable and thus unreliable for comparative purposes, the usual basis of comparative discussion will be the remainder.

Individual and group results for series A-1-a are given in Figures I and II and in Table I (p. 20). Nine subjects in all served in this group. This includes the writer whose peculiar knowledge of the situation makes her results not strictly comparable with the others, and one subject who was forced early to discontinue the sittings. This leaves seven whose results are considered in computing group averages.

TABLE I

STANDARD SERIES

Showing results for Group A-1-a *(with knowledge) and Group* A-1-b *(without knowledge)*

Subjects	No. of Sittings	Visual Acc. 53	66	79	92	Av.* L.D. 1st 5 trials	Av. Rem. 10 da.	Av. Rem. Total	Per cent Readj. 10 da.	Per cent Readj. Total
Group A-1-a										
H.L.K.	12	55.1	69.3	82.7	94.7	18.7	9.9	8.8	47	53
M.R.G.	25	52.8	65.7	79.5	92.7	20.7	12.5	12.2	40	41
O.B.B.	22	52.8	65.7	79.2	92.7	20.5	16.9	9.5	18	54
H.R.K.	23	55.5	65.5	78.8	92.4	21.9	14.7	9.7	33	56
M.F.R.	19	53.6	67.7	81.0	93.8	18.4	11.7	8.7	37	53
W.A.O.	27	55.7	68.4	81.1	93.1	16.8	9.4	3.5	44	79
P.R.	10	....	....	....	....	17.1	12.4	....	28	..
Average		54.2	67.0	80.4	93.2	19.1	12.5	8.7	35	56
Group A-1-b										
M.O.W.	28	....	....	....	....	16.9	13.7	10.6	19	37
D.S.	15	....	....	....	....	22.6	9.8	9.7	56	57
R.R.	11	....	....	....	....	12.4	7.8	7.5	37	40
M.McF.	35	....	....	....	....	18.9	11.3	8.6	41	54
Average		....	....	....	....	17.7	10.6	9.1	38	47

* L.D.—linear deviation.

The four curves of H. R. K., presented, as typical ones, in Figure I, show a gradual and steady slope, extending over 16 days' sittings, after which for eight days there is only a slight wavering with no improvement. There is a striking correspondence in the shape of the curves for the four buzzers, a slight change in one curve for a day's sitting almost always corresponding to a similar change in the other three curves. These facts indicate that whatever causes are at work to produce the "learning," operate in a regular and consistent manner. The relatively straight line from the 16th to the 23d sitting seemed at the time to indicate that the subject had reached the limit of improvement, and so the sittings were discontinued. Later experiments would indicate that this may have been only a "plateau," and that another period of improvement might have set in. The drop in the curves at the fifth sitting may have been due to the unusual fatigue reported by the subject at that time. Of her initial linear devia-

tion of 22 cm., Table I shows that H. R. K. recovered finally 56 per cent, with a final remainder of 9.7 cm.

Questioning at the close of the series with distorted vision revealed the fact that H. R. K., while aware that the distortion was to the right of the actual position of the buzzers, was not aware either of the extent of her error or of the fact that she was gradually, as the sittings progressed, reacting farther and farther to the left. She could imagine no factors that could have caused her thus to change her localizations, beyond the mere fact of knowledge of the direction of the distortion.

Similar in type to the results of H. R. K. are those of H. L. K., M. R. G., and M. F. R. The curves for all of them (not given in the figure) show the same gradual and steady progress and the same correspondence in the curves for the four buzzers. They differ in rate and amount of readjustment effected, M. R. G's progress being very slow and amounting to only 41 per cent of recovery of his initial deviation after 25 sittings, while H. L. K's progress (the most rapid in the group) amounted to 53 per cent of her initial deviation in the course of only 12 sittings. If it had been possible to continue H. L. K's sittings, it seems likely that she might have finally entirely overcome her remainder of nine cm., although it is true that for the last five of her sittings she showed no improvement.

The results of two subjects in this group, O. B. B. and W. A. O., require special discussion. They are presented graphically in Figure II. In this figure as in succeeding figures only two curves are shown although curves for all four buzzers were originally plotted. The curves for the four positions are so nearly alike that it was not thought necessary to present them all here. In each case, then, curves for buzzer No. 1 (53) and buzzer No. 4 (92) only are given (except for Figure III where curves for No. 2 and No. 4 are given). These two are taken because of the four they differ most widely in the case of practically all subjects. (It will be noted that the curves for buzzer No. 4 almost universally show relatively closer approach to the actual position of the buzzer, than curves for buzzer No. 1. In general the farther to the left the buzzer, the greater the degree of the apparent readjustment as

indicated by the curves. This fact can be explained on mathematical grounds, as set forth in the discussion of experiment A-2-b, on page 42. In this figure the numbers on the abscissa again refer to the numbers of the sittings, but the numbers on the ordinate represent this time the number by which the localizations for each day deviate on the average from the true position of the buzzer, indicated by the straight dotted line. Thus the curves show from day to day a gradually decreasing deviation. In every curve presented in the figure the first point, for the first day's sitting represents the deviation of the actual initial localization for that particular buzzer, and not the average of the five trials for that day. This is done to give a true idea of the actual range of the deviation. A truer picture of succeeding progress, however, because more measurements are considered, is given by letting the point for each day represent the average of the five trials for that day, and so the second and succeeding points on the curves each represent the average of five trials for a particular day's sitting.

The method of plotting used in Figure II holds for all the succeeding figures except for III and IV where special exceptions are noted. It will help in understanding the figures to remember that the lower curves represent buzzer 1, or position 53 on the scale, to the subject's right; and that the upper curves represent buzzer 4, or position 92 on the scale, to the subject's left.

The results of O. B. B. are peculiar, in that unlike the other subjects discussed his improvement was not gradual and steady from sitting to sitting. In his case, after a short rise from the first to the third sittings, the curves settle down into relatively straight lines showing no further improvement until the 12th sitting, after which they rise rapidly to the 17th before terminating in the five day "plateau" which may or may not mark the limit of improvement. Reference to Table I shows that while within the first 10 sittings his average remainder was as large as 16.9 out of an average initial deviation of 20.5, by the end of the 22d sitting it was only 9.5. Otherwise stated, for the first 10 sittings the readjustments effected was only 18 per cent, but at the 17th sitting it had jumped to 54 per cent. It is results like

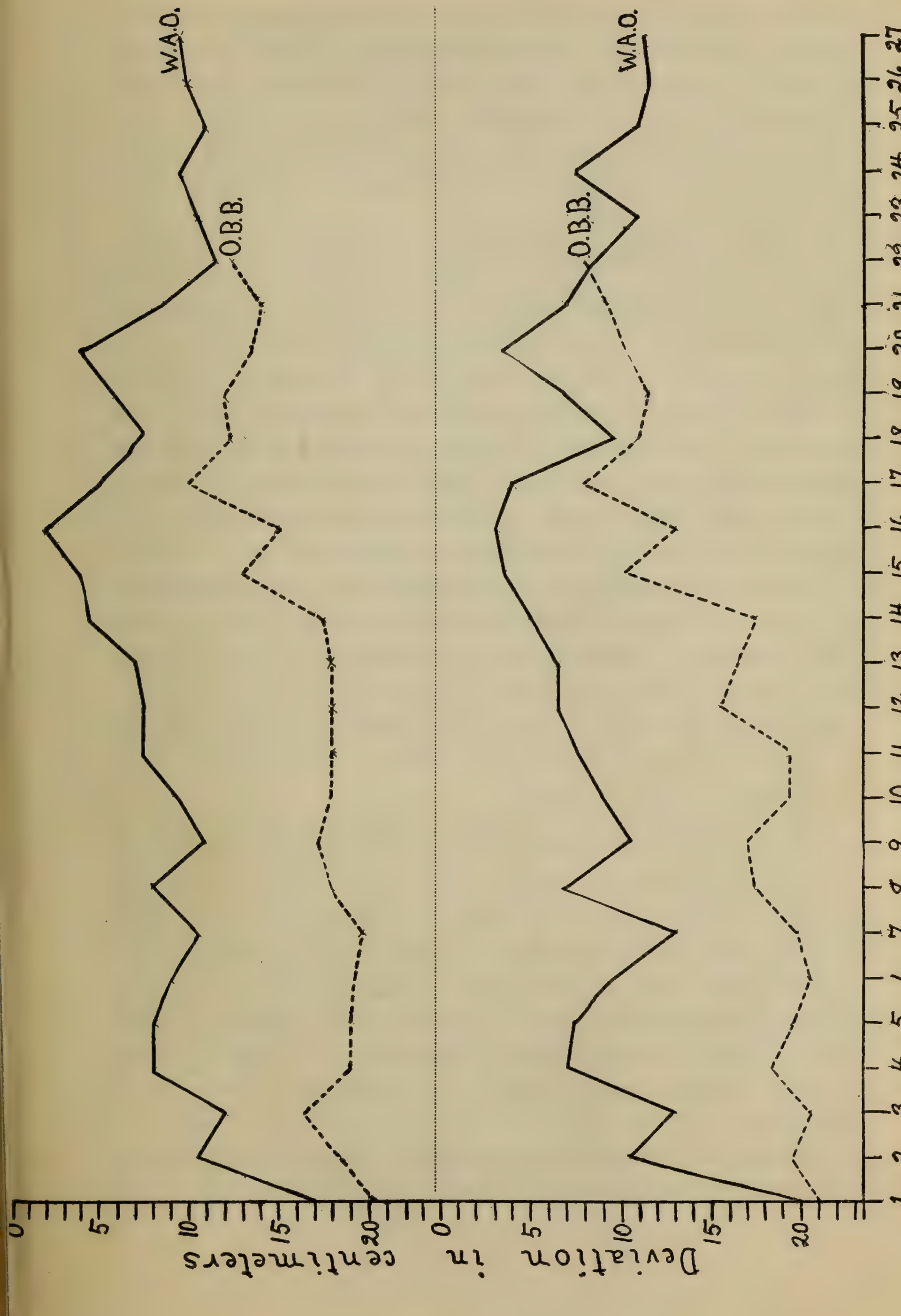

FIG. II. Standard Series. With Knowledge.

these of O. B. B. which first made the experimenter doubt the validity of any criterion for deciding when a subject has reached the limit of adjustment. Later results in this and other series confirmed this doubt and suggested that in every case there was a genuine possibility that if the subject only kept on long enough, he would finally completely readjust himself to the new visual situation.

O. B. B's comments as the sittings progressed are suggestive. Remember that there were no obvious clues by which he could judge the position of his finger at any localization. In the first sittings he reports feeling very uncertain and "helpless" while reaching out. From the ninth sitting on he reported feeling more confident, although he didn't know why he should be. At the 12th sitting (when in fact the first objective indication of the rapid rise appears) he reports "Feel at home now—not lost as I was at first," and "I bet you I am not far off from the true position." (As a matter of fact he was still 16 cm. off!)

At the 18th sitting when he had reached his smallest remainder (9.5 cm.), he reports "I feel perfectly at home, but don't know what I'm doing." When questioned at the end of the experiment, he was unable to state just what made him feel as he did. While aware of the fact that his manner of localization was changing, he had not been conscious of the clues on the basis of which this change in reaction occurred.

The other peculiar case calling for separate consideration is that of subject W. A. O. These curves rise, not smoothly, but in a rather zigzag fashion, until at the 16th sitting the average remainder is only 3.5 cm., and for two of the buzzers the curve actually meets the line, showing complete readjustment for these positions. This is unusual progress. But the peculiar thing is that at this point the curves begin to descend again, until by the 26th sitting W. A. O. has apparently unlearned all that he learned! By this time he is again within five centimeters of his initial deviation.

The subject's comments as the sittings progressed may help to explain this unusual situation. During the fourth sitting (which

marks a high point in the curves) he says "I feel more and more confidence that I am hitting these, but don't know its source." At the next sitting (fifth) he reports that he knows the direction of the error—to the right. Once in awhile he has, because of leaning farther back from the table, obtained a glimpse of his sleeve and the direction of his arm in reaching out for the buzzer. This gave him the clue. He has also seen, two or three times, the beginning of the experimenter's movement to the right to note the position of his finger. At the 16th sitting (the point of greatest readjustment) the report is "The thing seems much more natural. Distances to the right don't seem so long, or to the left so short, as at first . . . This leads me to think I'm adjusting or learning to react naturally." But this "natural" reaction he thought was to a point in each case a good number of centimeters to the right of where the buzzers actually were. With the 17th sitting the downward slope begins. At the 18th, 21st, and 22d sittings he reports being unusually tired and sleepy—"Am consistently getting too little sleep these nights." At the 22d sitting he speaks of having been self-conscious lately and more uncertain because of hearing remarks from the experimenter and Professor X about his "queer" record. At the 23d sitting he says "I feel that I am doing well. I reach to the right so it feels a long distance—that's the way it has been feeling—it seems farther than it looks."

Now on the face of it, it would appear that W. A. O. was influenced unconsciously by the mere knowledge of the fact of deviation to the right, gradually to approach the actual position of the objects, until he had practically overcome the deviation. At this point (16th sitting) he reported such confidence in the naturalness of the reactions that the experimenter questioned him more closely than she usually questioned subjects, concerning the extent to which he had been following the directions to *ignore* the fact of distortion. This, it would seem, made him self-conscious; and when on the next day his fatigue caused a natural slump in the curves, the fact that he thought the experimenter "seemed worried" at his record, increased his self-

consciousness. From this point his determination conscientiously to *ignore* the distortion to the right simply meant that it was emphasized in his mind, and his later reactions were influenced by the unconscious tendency to react farther to the right than he had been reaching. Whether or not this is the true explanation is a question.

Consideration of group A-1-a as a whole brings out some interesting points. In the first place while a general tendency to build up a new spatial coördination is apparent, there are well marked individual differences. Of those who did show a decided readjustment, the amount varied from an average total remainder of 12.2 in the case of M. R. G. to as little as 3.5 in the case of W. A. O. One subject, the writer, showed only a small amount of wavering in her curves, and no definite tendency whatever to readjust. Another subject, P. A. R., made no really significant advance within the 10 sittings he took, and it is a question whether like O. B. B. he would have shown a spurt of progress later had he continued the experiments. Speaking in terms of per cents of readjustment, of the eight subjects who continued presumably up to the limit of improvement, six showed a per cent of readjustment of over 50, while one attained only 41 per cent and one (the writer) remained at zero percent. The highest per cent was 79 and the average *total* per cent was 56. The average per cent for the 10 day period was 37.

Not only in amount but also in rate of adjustment are marked individual differences apparent. While in general the curves show a rapid increase for the first three sittings and then a gradual increase up to the "plateau" which terminated the sittings, one set, those of O. B. B., shows after the initial rise a long level stretch and then a sudden rise. Another, that of W. A. O., exhibits a gradual but quick approach and then a retrogression. One set of curves, those of M. R. G., drags out over 25 sittings and then shows a readjustment of only 53 per cent. H. L. K's per cent within a 10 day period is 47, while O. B. B's is within the same period only 18.

It remains now to consider to what extent the subjects were aware of the direction and amount of the deviation and what

may have been the effect of their attitude toward the experiment. In the first place all knew that the direction of the deviation was to the right. At least one knew before starting, through noticing the position of the prisms in the frame, but most of them became aware of it only after the sittings were under way, through noticing the change in length of the reach to the right, as compared with the corresponding movement in the previous normal series. All conscientiously aimed to ignore this fact of distortion in making their localizations, and some were unaware that they were making any readjustment. M. R. G., for instance, who estimated quite well the extent of his initial error, drew a diagram after his seventh sitting to show that he must be hitting in the same place each time. Most of the subjects felt each time that the finger was just beneath the buzzer. In this respect H. L. K. is an exception. When she was making a localization it seemed to her that she was touching the right place, but as soon as she closed her eyes her finger seemed out of place. Toward the end of her sittings she reported feeling more natural—that her finger seemed less out of place. This is due to the fact that when she first started she retained the kinaesthetic set from the preceding series, and felt clearly, as most of the other subjects did not, the difference between that and the different "feel" due to the deviation to the right. It is of interest here to note that H. L. K's progress was the most rapid in the group. A. S. F., who after the quick readjustment of about eight centimeters in six sittings had to discontinue the experiment, reported "I feel that the desire to correct to the left influences me, although I try to ignore it." She is the only one to report such a feeling.

The results of the first series of experiments seemed to indicate that knowledge of the direction and extent of the deviation might well be the chief factor in the process of readjustment. We decided, then, to give the same series to a group of subjects so chosen, and with experimental conditions so arranged, as to exclude, if possible, every source of knowledge of the nature of the deviation. The possible sources of knowledge in the series as first given, A-1, together with the way in which these were

obviated with the second group of subjects, in A-2, we will discuss point by point.

1. A knowledge of the direction and extent of the deviation might be gained from other subjects who had finished the series and knew of the conditions. This was avoided in both A-1 and A-2 by strictly cautioning each subject not to discuss the experiment with others.

2. The subject might gain such a knowledge through noticing the sudden shift to the right in the position of objects at the moment of putting on the glasses. In A-1 this was avoided by having the subject turn away from the table and close his eyes while the glasses were being put on. In A-2 the additional precaution was observed of having the subject led about the room with eyes closed and then seated in a chair facing in a direction different from that in which he had previously faced, before the glasses were put on and before he was permitted to open his eyes.

3. Knowledge might be gained through a comparison of the apparatus or general surroundings as viewed through the glasses, with their remembered appearance without the glasses. In A-2 this possibility was obviated by taking as subjects only such students as had never been inside the experimenter's room, seen the apparatus, or heard it described. Hence since the glasses were put on and taken off in another room, these subjects had neither directly nor from the report of others any knowledge of the normal appearance of the apparatus or the room.

4. The subject might learn the nature of his error through noticing the position assumed by the experimenter in bending over to get the record, either through accidentally opening his eyes or through a too quick movement of the experimenter before the eyes were closed. To obviate this source of knowledge the black curtain previously described was used to screen the experimenter's movements while taking the record.

5. The subject might discover the direction of the distortion through retention of the kinaesthetic set from either the previous normal series or the auditory series, and its comparison with the new set due to the deflection to the right. This comparison was

indeed reported as the source of such knowledge by some of the subjects in A-1. In A-2 such a possibility was provided against by having the subject start in with the main series, omitting the preliminary tests without the glasses.

6. Again, the unnaturally long reach to the right might suggest, even were there no preliminary tests, that the distortion was in that direction. To eliminate this possibility in A-2, the extreme right hand buzzer which involved the only long reach upon which subjects had commented, was omitted. This left only three buzzers to be localized.

7. A seventh possibility is that the subject familiar with the effect of prisms might easily reason out both the direction and the approximate extent of the deviation, through the mere observation of the prisms before putting on the glasses. In A-2 this possibility was obviated by not permitting the subject to see the glasses at any time, and by making sure before the sittings began that he had not heard from any source what kind of glasses were being used.

8. Finally, the subject might gain knowledge of the character of the deviation through his unusual tactual-kinaesthetic orientation with respect to the edge of the table and the cover. In other words through feeling of these edges as he sat looking at the buzzers he might find out that the line of vision was not perpendicular to these edges as he might expect, but one forming an angle to the right. The same sort of clues might be gained for some subjects from the contact of the lower part of the board forming the front of the table, with the body or the knees. In order to eliminate these possible clues, several precautions were taken. The lower section of the front board was sawed out in order to prevent contact. The subject was strictly forbidden to make exploratory movements with his hands between trials. At the beginning of the sitting the experimenter put the subject's hands in position in front of him. The first paragraph of the "Instructions to Subject", covering this point, is as follows:

"When seated in the chair, let the right arm lie along the edge of the table, and the left extend out on the table, but not more than 90 degrees to the left. Between trials either keep the arms

in this position, or swing the chair away from the table and let them rest in your lap. At no time make any exploratory movements except when directed to."

The eight sources of knowledge discussed above include all possible ways, we think, in which the subject might gain a knowledge of the direction and extent of the deviation produced by the glasses. They were all eliminated in the series as given to the second group of subjects—series A-2. This does not necessarily mean, of course, the elimination of all possible sensory clues on the basis of which the subject might unconsciously react.

b. *Experiments Without Knowledge.*

Aside from the paragraph quoted above, and a sentence explaining the use of the curtain, the instructions for Series A-1-b were exactly as in A-1. The glasses were put on the subject in the manner described, in an outer room. He was then led into the experimenter's room and to the subject's chair, in which he managed to seat himself by the aid of touch and kinaesthesis. When his hands had been put in position by the experimenter he was permitted to open his eyes. He then began the localizations according to the instructions he had received. In order that these instructions might be thoroughly impressed upon the subject, they were typewritten and he was required to study them before each of the first three sittings.

The trials were given in the same manner as in A-1 except for the use of the curtain. Since only three buzzers were used seven trials each were given in a sitting. This makes the total number of trials and of minutes 21 instead of 20, but such a small difference could hardly be expected to have any appreciable influence on the results.

At the conclusion of the sitting the subject was led out of the room with eyes closed. He was not permitted to open his eyes until the glasses had been removed and put out of sight.

Individual results for this series are given in Table I, p. 20. In Figure III are presented two typical sets of curves, those of subjects D. S. and M. O. W. Since in this series buzzer No. 1

was not used, the two curves given for each subject are for buzzers 2 and 4.

These results are surprising. The subjects in this group, although in at least three cases ignorant by their own later state-

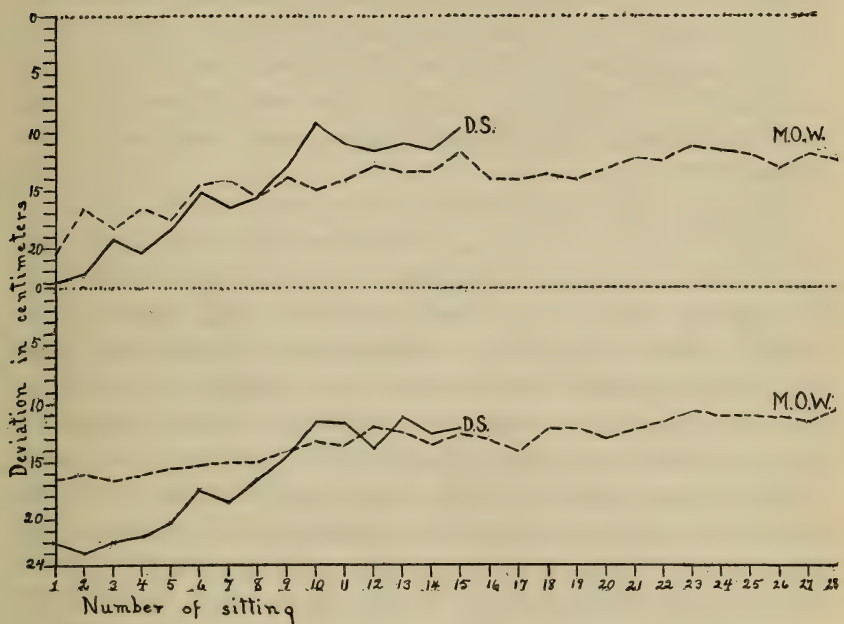

FIG. III. Standard Series. Without Knowledge.

ments of the nature, direction, or extent of the distortion, showed during the first 10 days just as marked a tendency to readjust to the new visual situation as did the subjects in the first group! In fact if we were to consider significant the small difference in amount of readjustment, they showed in the first 10 days more of a tendency, for on the average their remainder is only 10.6 cm., while the average for the first group is 12.5 cm. Even this small difference decreased with later sittings, and so allowing for the slight variation in the experimental conditions, the logical conclusion would be that knowledge of the conditions of the distortion apparently has no effect either on the rapidity or the rate of the readjustment. Comparison of the average curves

for 10 days of these two groups, as shown in Figure X reveals their essential similarity.

The curves for this group show the same consistency and the same sort of individual differences as in the first group. The two longest curves in the group, those of M. M. and M. O. W., show continuous and very gradual progress, extending over 28 and 35 days respectively. M. M.'s results, with 41 per cent of improvement within 10 days and 54 per cent within 35 days, especially seem to indicate that improvement may go on indefinitely.

The comments of individuals are of interest here. R. R. reports that she did not know at all the direction of the distortion, though she had a vague feeling that it was to the left. "I hadn't the slightest idea as to the kind of lenses—I felt I was to the right but didn't know why at all—thought my finger was about one inch to the right of the buzzer . . . I felt I was hitting in the same place all the time . . . For the first few sittings my finger didn't feel right. Later the finger felt just where it landed."

Early in the series M. O. W. found out that there was some sort of disparity from seeing the experimenter in one place when she went to the door and "hearing her talk in another." But at the eighth sitting he reports "I don't know what these things (glasses) are doing. For all I know you may even be behind me, and everything turned clear around." It was only at the 18th sitting that M. O. W. could have guessed something of the direction and the extent of the error, when he unthinkingly reached out his hand over the cover to hand the experimenter his pencil —and of course noticed his error. He announced that he would try not to heed this, and at the end of the long series of sittings felt that it had not influenced him in the least. He was astonished to find that he had not been hitting in the same place all the time.

A distinct illusion that developed in M. O. W.'s case is striking. He took it for granted that when he was seated at the table he was sitting "at right angles to it", with the three buzzers directly in front of him. Therefore when he localized a buzzer, especially the middle one, he thought his finger was striking the board at the back at a right angle. As a matter of fact the buzzers ap-

peared over 20 cm. to his right and hence the finger struck at an angle nearer 45 degrees than 90 degrees. But to him all the time the angle was a right angle, and the tip of his finger seemed pressed squarely against the board. The illusion was made clear when at the end of the series he made a few trials without the glasses. This time his finger actually was at right angles to the board and the tip against it; but he reported a very strong feeling that now the angle was acute, and that it was with the side of the end of his finger that he seemed to be touching the board! The illusion was so strong and persistent that he could not get rid of it. This is an excellent illustration of the relativity of the tactual local sign system.

It is the case of D. S. in this group which is most unequivocal. (See curves in Fig. III.) Hers was the most rapid adjustment, yet she felt all the time that she was hitting to the *left* of the buzzers! "I haven't thought about what the glasses were doing each day—or at all," she said. "They merely made things more hazy . . . Every time I put my finger in place I felt that if I moved a little to the right I'd be more accurate." To her also the three buzzers seemed directly in front. When she was taking a sitting with the glasses after her regular sittings were over and the situation finally made clear to her, she said, "Seem to be reacting as usual. Still I could almost swear I am going to the left of the buzzer each time, although I know from conversation I was going to the right. . . The kinaesthetic clues, though I watch for them now, don't help me."

2. Effect of Position of Body, Head, and Eyes

The results of the second group, A-1-b, show clearly that knowledge of the nature and direction of the distortion is not an essential condition of readjustment. The next hypothesis that seemed most fruitful concerned the effect on the localization of the buzzers of head and body position.

It is reasonable to suppose in the first place—and casual observation confirms the view—that in fixating the right hand buzzers, 53 and 66, the head of the subject was turned relatively farther to the right *than was the body.* This is because under the

conditions of distortion the point midway between the two end buzzers appeared to be about 20 cm. to the right of the main perpendicular axis of the body of the subject, considering him as facing the table squarely. Now the subjects (in view of the auditory series included) were all told to move the head *and body* freely, as they chose. Bu in fixating a point far to the right the head would naturally be turned farther than the body, since we are accustomed to fixate objects with relatively little body movement as compared with head movement. Now the arm and hand might naturally tend to assume a position in line with the central body position rather than that of the head, for the following reason. While wearing the prismatic glasses, the subject, in fixating the buzzers *as they appear to him,* turns his head and eyes about 20 degrees to his right. But the buzzers are in the center of his field of vision, and as he reacts to them, it is with the same "set" that he would have were they directly in front of him. (Cf. M. O. W.'s illusion of position.) Now in the course of his normal experience reacting "in front" has come to mean always reaching out more or less at right angles to the *body.* This association may well persist in the abnormal situation, so that if the head is turned farther to the right than the body, the subject in reaching out for the buzzers "in front of him" as they appear to be, will tend to reach out according to the old habit in front of his *body.* This might well explain a tendency to depart from the initial localizations far to the right, in the direction of the central body position. We might explain the gradual nature of the change by a decrease in attention to the accuracy of the localization as the process becomes automatic.

In the second place the localizing of buzzer 53 involved a reach to the right unnaturally long for most subjects, who always commented on the length of the reach. When an unusual reach in any direction is involved, a reach accompanied by noticeable muscular strain, would not the mere influence of inertia cause a relaxation in the strain of reaching when, as in this experiment, there is no practical check on the correctness of the reaching movement? And might not the tendency connected with the buz-

zer 53 conceivably influence the reaction to the other buzzers in similar degree?

It is clearly possible, then, that the readjustment to the left may be caused first by a tendency for reaching movements to be in line with the central bodily attitude rather than that of the head; and second by a tendency to react in the direction of least muscular exertion. Considering both of these possible sources of influence, might we not expect a subject under normal conditions of vision, to show a progressive "adjustment" to the left in seeking to localize buzzers placed as far to the left as the buzzers *appeared* to be when distorted by the glasses?

Conversely, let us suppose a subject wearing the prismatic glasses, and localizing buzzers placed so far to his *right* that the muscular strain and disparity in head and body position would be to the right in localizing the buzzers as distorted, instead of to the left. Might we not then expect to find such a subject showing a tendency to "readjust" to the right instead of to the left, so that our curves would indicate a tendency to depart from the actual position of the object instead of a tendency to approach it?

a. *Experiments With Undistorted Vision.*

In order to find the relation of body position to readjustment on the basis of these two converse possibilities, we arranged two groups of experiments. In the first, A-2-a, we aimed to keep the conditions exactly as in A-1-a, the only difference being that glasses with lenses made of plain window glass were substituted for the prismatic spectacles. The reach to the right was about the same as in the earlier series since all four of the buzzers were set over to the right along the rod about 18 cm., that being about the average amount of linear distortion. A support for the rod prevented an exact shifting, the new positions being at 35, 48, 64, and 74 along the scale instead of at 53, 66, 79, and 92 as formerly. Instructions given the subjects were exactly the same, nothing being said about might be expected except in the case of one, A. M., who was given the suggestion that the glasses distorted the visual field and that she might be expected to adjust

to the left. Five subjects took the test—A. M., A. H. M., G., L. M. J., and E. S. R.

The results did indeed for all the five subjects show a curve. But the curve was very unlike that obtained for the preceding groups. It showed a rise, usually within the first three or four sittings, of between one and four cm., after which it settled down into a fluctuating "straight" line which rose at times only to descend again to practically the original level. The average curves for all four positions for 10 days are indicated in Figure X by the wavy line. It will be remarked at once that the curves are not much lower than for the first two groups in which the glasses were worn. But the significant thing is that while the curves for the first two groups keep on rising until half way up, those for this group continue to cling close to the lower line.

It is impossible to compare the groups in respect to remainders or per cents of readjustment, for in the group under consideration we have no individual linear deviations and no "normal" reactions as standards. But we *can* take as a measure the difference in centimeters between the highest point reached in 10 sittings for each buzzer, and the average of the five initial localizations for that buzzer. Taking the averages for groups A-1-a and A-2-a we get the results shown in Table II. (The numbers represent the four positions of the buzzers, from right to left, number four being at 92 for group A-1-a, and at 74 for group A-2-a.)

TABLE II

Amount of Improvement in 10 sittings

Group	Number of Subjects	1	2	3	4	Av.
A-1-a	7	7.9	6.7	6.4	5.8	6.7
A-2-a	5	4.3	3.3	3.3	3.3	3.5

It is seen that the average highest amount of increase over the first localizations is twice as much for the group wearing the prismatic glasses as for the present group. Only three of the five subjects in this group, unfortunately, continued the sittings beyond the tenth. Of these curves of G. shows an increase in amount of improvement of only 1.8 cm. in the last five sittings.

Subject E. S. R. continued for 26 sittings with no increase over the high point in his seventh sitting, but a slight and gradual decrease which brought his curves down at the end to within an average of a half centimeter of his record for the first sitting. (See curve Fig. IV, p. 38.)

At this point E. S. R. was started in the standard series, wearing the prismatic glasses. In 23 sittings he had gained 8.1 cm., an improvement of 41 per cent over the first standard sitting. Although his rate of improvement is slow, it seems clear that it is a readjustment to the new visual conditions. In Figure IV, p. 38 the unbroken line shows E.S.R.'s "progress" in the undistorted series, the distance from the lower dotted line representing average deviation in successive day's sittings from the actual position of the buzzer. Superimposed upon this curve is the broken line showing his progress while wearing the glasses (distorted series). Here the distance from the upper dotted line represents the actual position of the buzzer. This figure points clearly to an essential difference in the type of progress without and with glasses. In the former case there is wavering with no true upward progress; in the latter the curve, while it fluctuates, keeps on steadily rising.

In line with these results, though less conclusive, are those of A. H. Her curves *without* prismatic glasses do not for 15 sittings rise beyond the highest point reached in the first 10 sittings (an improvement of 3.8 cm.). But between the first and second sittings *with* prismatic glasses there is an average increase of 4 cm., pointing plainly to the operation of an effective incentive to readjustment.

It must be confessed that we have too few subjects in this "undistorted group" to justify an unqualified conclusion that without the prismatic glasses progress does not continue. More data are needed. But we can say that very probably the true situation is this: The difference in muscular strain caused by the unequal reach to the right, or the natural tendency to react with reference to the central body attitude, or both, do indeed result in a tendency to "readjust" to the left. This tendency, however, is very slight, and effective only for a short period. It could very well account for the rapid but brief initial rise which

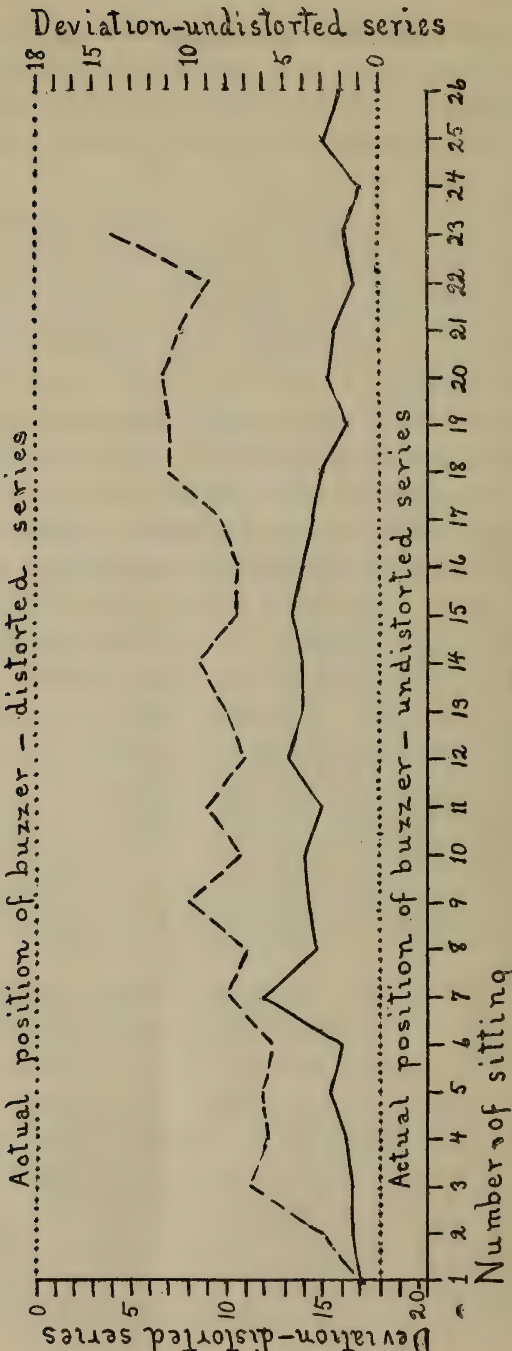

FIG. IV. Standard series. Undistorted and distorted vision. Subject E. S. R. Buzzer 1.

we noted as characteristic of the curves for the first two groups; but it could not account for the continued and steady progress of the curves which indicate a per cent of readjustment as high as 79. It would have been possible to devise an extra series to isolate the factors of muscular strain, due to long arm reach, and of head-body disparity; but owing to limited time this was not done. The two factors together did not prove, in fact, to have much influence, as will be brought out later.

b. *Experiments With Distorted Vision.*

In the second group of experiments to test the effect of the bodily attitude and muscular strain situations, our aim was to see if we could obtain a curve in the opposite direction, or at least one approximating a straight line, by shifting the buzzers far to the *left* as suggested, so that the localization of the buzzers *as distorted* would involve an unusual reach and a turning of the head to the left. Certainly if the first adjustment were independent of the prismatic glasses, such an adjustment could be produced in this way in a direction contrary to that which theoretically would take place to "overcome" the prismatic deviation.

In the new test, A-2-b, for three of the subjects all conditions were exactly as in A-1-b (Experiments without knowledge), except that the three buzzers were set far to the subject's left in such a position that when distorted, the one farthest to the right would appear to be, even for the maximum linear deviation, slightly to the left of the normal perpendicular to the central body axis, while the localization of the one farthest to the right would involve a long reach accompanied by unusual muscular strain. The positions on the scale for the three buzzers were 91, 101, and 117.

In Table III, p. 41, is a summary of the numerical results for this group. Fig. V, p. 40 shows typical curves, those of E. H. E. and R.

Four subjects took this test, all continuing for at least 10 sittings. Not one of them showed a tendency to readjust to the right. Three on the contrary showed a very marked readjustment to the left, working thus *against* an increasing sense of muscular

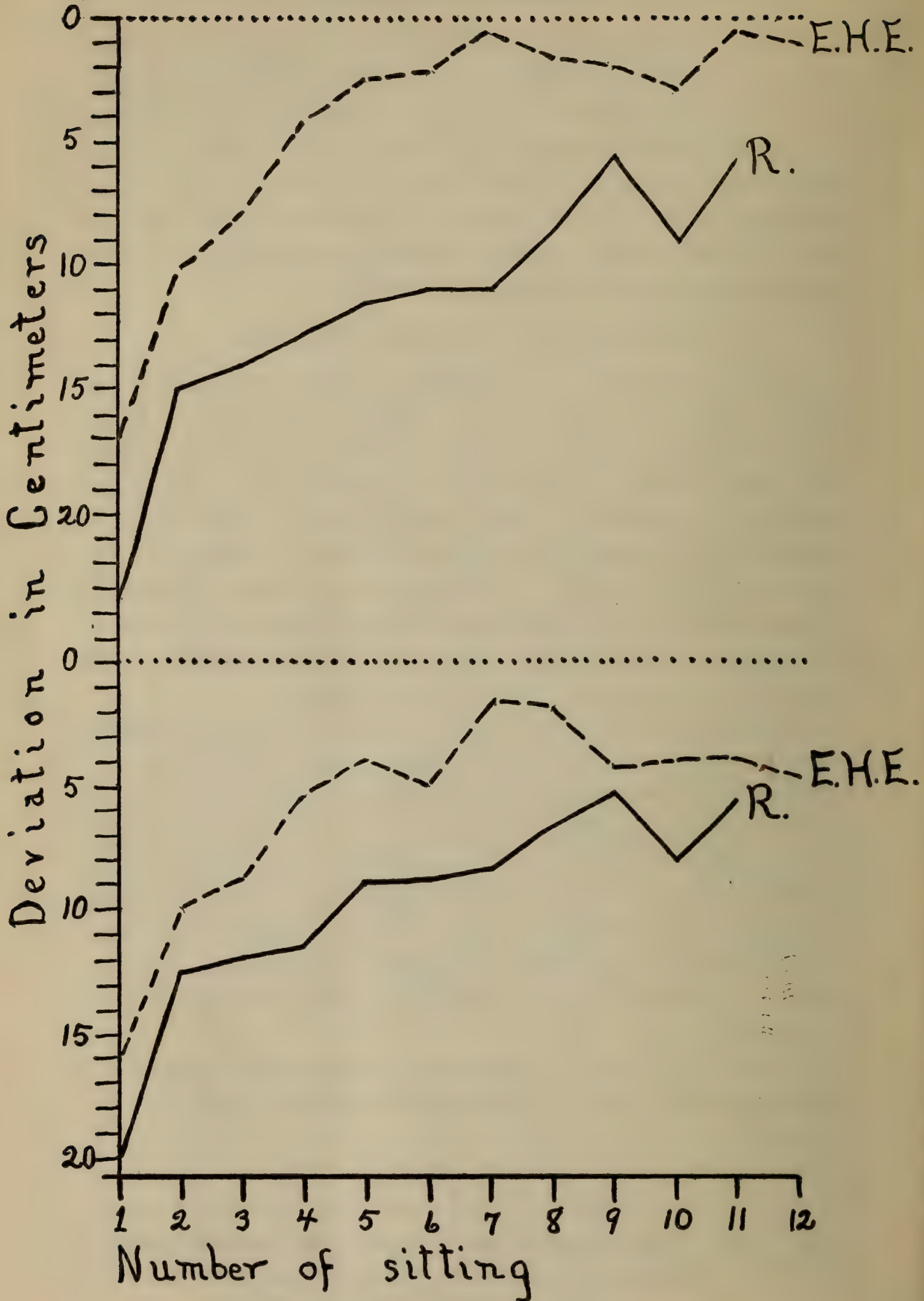

Fig. V. Standard series. Distorted.

strain, which they mentioned. The one who did not readjust remained more or less on a level for a few days, then fell to a level only very slightly higher than for the first sitting.

Of the three subjects who showed marked improvement, none were aware of the extent of the deviation and were even uncertain of its direction at times. E. H. E., on seeing her results, felt greatly surprised that she had been making a progressive change; and that the "feeling in her arms" did not inform her of this. She thought she had been hitting in the same positions all the time.

H. A. C. was very familiar with all the conditions of the experiment, and a highly trained observer. At the fifth sitting he reported that all the time he felt as if he were going too far to the left, and when his finger got there, he felt that if he moved it a little to the right, it would be more correct. At the ninth sitting he said, "Don't know whether I've improved or not—if I were going to guess, would say probably I hadn't—largely guess work."

In Table III is a summary of the results for the four subjects for a 10 day period.

TABLE III

Readjustment with Buzzers at the Left, Distorted Vision.

Subject	Average Remainder	Per Cent Readjustment	Average Initial L.D.
P. R.	5.0	68	15.5
F. O. D.	2.1	85	10.0
E. H. E.	.8	99	10.2
H. A. C.	10.0	22	9.8
Average	4.5	68	12.3

On first glance at these figures it would seem that the readjustment even on the average was so much more rapid than that in the standard series as to require the supposition either of another causative factor or of an unusual coincidence in the matter of individual variability. But consideration of the effect of the changed position of the buzzers explains this apparent discrepancy. The amount of linear deviation varies regularly with the size of the angle included between the line of fixation

and the line of projection (the scale), according to the formula $b = \frac{c \sin B}{\sin C}$ where b is the linear deviation (L. D.) and B the angle of deviation of the prisms. Now if the other angle, A, formed by the line of fixation for a buzzer and the scale is small, then the L. D. is correspondingly smaller. Now all the A's in this situation are less than right angles, while in the other groups all were greater. This means that the L. D. will be much smaller, and in fact we do find the average L. D. here, 12.3 cm., to be less than two thirds of the average L. D. for the first series A-1-a and A-1-b, which is 19 cm.

Now with a smaller L. D. the same absolute *amount* of readjustment would not only correspond to a disproportionately larger *per cent* of total readjustment, but the *remainder* would also be smaller. For example, suppose the absolute amount recovered by two subjects in each group to be 5 cm., and the L. D. to be 20 cm. Now for the subject in A-1-a this would represent 25 per cent of readjustment and a remainder of 15 cm., while for a subject recovering the same distance in group A-2-b, the per cent of readjustment would be 50 and the remainder only 5 cm. Hence we see that the two sets of results are not directly comparable, and may assume that in reality the average L. D. of these subjects would be about the same as in the first group, were conditions the same; and that the amount of readjustment would not be greatly different.

Now under the conditions of this series with distorted vision the head must be either in line with the body or turned farther to the left. Hence the fact that marked readjustment to the left nevertheless occurs proves conclusively that although the head-body discrepancy may have been, and presumably was, slightly effective in causing the original readjustment, a much more effective cause must have been at the basis of the readjustment for most subjects. The same statement holds for the hypothesis that the original readjustment may have been due to a gradual relaxation in attention to localization with a consequent following of the direction of least bodily effort, for in this case readjustment took place in the direction of increasing bodily strain.

It becomes necessary again to search for other possible factors. We have a gradual change in method of localizing, marked and steadily increasing for most subjects, without any known basis, sensory or ideational, for such a change. Now every reaction must have a conditioning stimulus, immediate or remote. What is the stimulus here?

After much pondering a possible solution of this problem came to mind, suggested by the line of reasoning followed in discussing the head-body position. Briefly the theory is as follows. The position of the eyes in the head is such that they are turned to the right of the head axis, just as the head is to the right with reference to the central axis of the body. It is the habitual tendency to react to the front as determined by head position rather than eye position which conditions the tendency to readjust to the left. The other factors of head-body position and of tendency to equalize strain may enter in as subordinate influences, but the main incentive to readjustment is the eye-head situation.

Let us see what the exact implications of this hypothesis are. It may be said that there are for the individual three distinct meanings of the word "front"—one with reference to the central axis of the body, one with reference to the head axis, and one with reference to the line of vision when the fovea is stimulated by the fixated object. Now it is reasonable to suppose the foveal front to be less dominating in the habitual reaction systems of the individual than the head front. In the first place the eye is much more active and varied in the direction of its fixation than the head. In the second place it is necessary to recognize the existence in this experiment of two different sensory aspects, visual and kinaesthetic, of the concept front, whereas normally the bodily reactions to the kinaesthetic and the visual situations are objectively the same. That is, the subject now *sees* the buzzer in front to be in one place, but with his head and body he *feels* that "front" is in another direction, farther to the left. If the subject wearing the glasses *saw* his head and body at the same time he *saw* the buzzer, it is possible that this old kinaesthetic set would be harmonized with the new visual situation and the localizations would be consistently in one place. But the glasses

are so constructed, and the conditions of the experiment are such, that the subject does not see any part of his head or body. Hence it is natural that the old or normal kinaesthetic reaction tendencies should be very strong when the subject is working under the injunction to reach out "in front", and that there should be a marked tendency to point in the direction of the head-axis rather than the eye-axis which is for the time being farther to the right.

At first when the subject might be expected to give particular attention to the localization of the novel visual object, he would respond to it by precise movements in harmony with the new visual situation. But since the attention of the subject gradually lessens and the process becomes automatic, it is quite natural that he should by degrees fall back into the more usual habit of reacting in harmony with the normal "feel" of the head. This would explain the gradual nature of the readjustment to the left.

The superiority of this explanation over the other hypotheses advanced lies in the fact that unlike them it works in the series with distorted vision just described. It is not hard to show that no matter what the direction of the line of vision, the eye will still be turned in its socket farther to the right than in normal fixation. In normal foveal fixation of an object the line of vision and the head-axis coincide. When the prism is placed before the eye of the subject, the object is deflected to the right, and in order to adjust properly to it the head is turned to the right together with the attached prism. But this turning of the prism again alters the angle of incidence of the ray of light from the object, with the result that it is refracted to the periphery of the retina. Hence and in order to obtain clear foveal fixation, the eye must turn still farther in the socket. Otherwise the object would be seen in peripheral vision, an unnatural situation for an object attended to. The amount of sequential turning of the eye is sufficient to make the eye-head discrepancy clearly apparent to the observer as the subject is in the act of localizing a buzzer.

This optical situation can be stated in a definite mathematical formula by the physicist, but it is sufficient for our purposes to recognize the mere fact that for every turn of the head there

will be a sequential turning of the eye still farther to the right, at an angle of noticeable extent, though less than the angle between the head-axis and the main body-axis. Taking into account the existence of this discrepancy, and the highly complex and delicate way in which the performance of any act is influenced by the total sensory situation at the moment, it is easy to understand the readjustment to the left as a perfectly natural adaptation to the changed sensory situation induced by the prisms. It is clear now why no marked readjustment occurs when the prisms are not worn.

The progressive character of the readjustment can be explained on this hypothesis in two ways. In the first place the subject might at first concentrate his attention on the visual stimulus and the correctness of his reaction to it, and hence react with reference to the "foveal front." Later, though the foveal fixation is still maintained, he might naturally relax his vigilance and fall comfortably into the more habitual manner of reacting with reference to the "head front".

Or, in the second place, he might continue consistently to react with respect to the foveal axis, but that axis itself might change, in, let us say, the following way. At first the subject, anxious to localize the object correctly, takes pains to get a clear foveal fixation. But this involves some muscular strain since the eye is turned farther in the socket than normally. And he *can* attend to the object visually through peripheral as well as foveal fixation. What is more natural than that, as the process of reacting becomes increasingly automatic, the eye should relax its tension and gradually assume a compromise position nearer its normal position in the head; or even continue until it has reached the normal position? This means that the eye-axis would slowly approach the head-axis, and finally, in some cases, coincide with it. Asuming that in this case the reaction of the subject is always with reference to the foveal front, the above assumption would account nicely for the progressive character of the readjustment to the left. Individual differences in readjustment would be due to physiological differences in susceptibility to muscular strain.

It seems probable that readjustment due to this prism-induced

eye-head discrepancy may be effected in both these ways, some subjects reacting in one way, some in another. That the general fact of the eye-head discrepancy is very significant for the process of readjustment appears highly probable. The chief merit of the hypothesis is that it will hold for the case in which readjustment to the left took place even in the direction of increasing bodily strain and in the face of a slight turning of the head to the left as compared with the body. For no matter what the direction of the object with reference to the body, we know that the eyes will always be turned in their sockets to the right of their normal position.

There are, however, some difficulties which indicate that this hypothesis is very likely only a partial explanation, and not sufficient to explain all the facts we have discovered in the course of our experiments. How, for instance, on this basis, can we account for the fact that in the case of R. D. in the Auditory Series readjustment occurred rapidly and surely, and then halted and remained on a level for ten days at exactly the point of objectively correct localization? R. D's localizations here were, moreover, far more accurate reactions than she had made to sound alone. According to the present theory why should the readjustment stop at any particular point, much less at this point? Unfortunately in none of the other cases in the first and second series where complete or nearly complete readjustment seemed to occur, were the sittings continued long enough to see if the process would go on indefinitely.

This hypothesis did not occur to the writer until after the conclusion of the experimental work for the investigation, when it was too late to check it up experimentally. In a later supplementary investigation, however, the writer hopes to carry out the experimentation necessary to clear up the matter.

It may be said parenthetically at this point that in the later series in which complete readjustment occurred, due to known sensory clues, the readjustment should on this theory go on, though at a slower rate, to a point some distance to the left of the actual position of the objects. There is no reason to assume that this would not have occurred, yet here again positive evi-

dence is needed, since the sittings were stopped when the actual position of the buzzers was reached.

VISUAL LOCALIZATION OF SOUNDING OBJECTS

1. First Group, Using Electric Buzzer

The second main series of experiments was designed to test the efficacy of sound as a factor in the formation of the new visual coördination. For the first group of experiments in this series one of the electric buzzers was used as the object to be localized. In this case it was sounded at each trial. One buzzer was used instead of four as in the preceding series, and shifted between trials to different ones of the four positions 53, 66, 79, and 92, according to a predetermined order. The object of using the one buzzer instead of four was first, to keep the quality of the sound as nearly constant as possible. It was found practically impossible to get four buzzers of the kind employed that were of the same pitch and timbre, or to equalize those we had. The second object was to make possible an easy identification of the sounding buzzer. If but one of four was sounding, it would be a hard task for a subject wearing the prisms to tell at once which one it was.

Before starting the main series of trials with distorted vision, a preliminary series was given to test the accuracy of the subject in normal auditory localization of the buzzer in the four positions. The subject, after being instructed how to reach out for the buzzer, was blindfolded and seated at the apparatus. At the signal "Ready," followed by the sound, he was to decide carefully at about what point along the rod the buzzer was, moving his head and body freely as desired, and taking all the time needed, the sound meanwhile continuing. When he had decided, he was to reach out and make the localization. When he touched the board the sound stopped. In order that the subject might not know or guess from what position the sound was to be expected, (1) he was not told that only four positions were used; (2) the trials were given in regular order but the order was frequently changed; and (3) the buzzer was moved noiselessly between trials, con-

versation going on in the meanwhile. The interval between trials was one minute. Fifty trials were taken for each of the four different positions of the buzzer, from 20 to 30 trials being given in a day's sitting.

When the preliminary series had been completed the subject began the series with distorted vision, with procedure exactly as in the first main series, A-1, except that the one buzzer, shifted between trials, was used instead of four, and that the experimenter gave the signal for reacting by sounding the buzzer instead of by placing her finger on it. The typewritten instructions were exactly as in the standard series, A-1, except for the change in describing the signal for reaction. Nothing was said about localizing the sound. The object was thus to see if the subject, while localizing the visual object, would be influenced by its sound, coming from a position to the left.

The results of this series as first given to four subjects seemed strongly to indicate that sound is efficacious as a factor in the formation of the new visual coördination. The progress of these subjects was noticeably more rapid than that of those in Series A, for in the 10 day period their average remainder was less by 24 per cent and the average remainder for *all* the sittings, or "total remainder," less by 41 per cent. While none of the subjects in the standard group showed a higher total per cent of readjustment than 75, and all but one fell below 60, only one subject of the four in the sound group (B-1) fell below 60, and one showed 100 per cent readjustment in 12 days. The sittings in both groups were continued until the apparent limit of improvement had been reached. Since on the average the individuals in the sound group had one less sitting than the standard group their smaller total remainder could not have been due to more practice.

In the course of these experiments with sound, certain of the subjects—and it happens the slowest ones—reported that they did not associate the sound with the buzzer at all. It seemed to come from another place, and so they got to thinking of it merely as a signal for reacting. One even persisted in believing, despite the assurances of the experimenter, that it was another

buzzer, behind the apparatus, that was sounding. This suggested the desirability of experiments to see if the fact of knowledge or lack of knowledge that sight and sound came from the same object, would make any difference in the rate of readjustment.

2. Second Group, Using Electric Bell

For this group it was necessary to use a sounding object in which the vibration at the time of sounding should be clearly visible to the subject. A "midget" electric door bell 3.5 cm. in diameter, mounted and made adjustable like the buzzers, and very similar to them in size and appearance, was used. The little hammer, painted a bright red, vibrated conspicuously when the bell was sounded. For the group in which the vibration was to be invisible, a small brass "wing" was made which could be quickly screwed to the upper part of the bell, and which effectively prevented the subject from seeing the vibrating hammer from any angle.

For these experiments with the bell the instructions to the subject were essentially as in B-1, except that for the group in which the vibration was visible the attention of the subject was called to the energetic tattoo which the little red hammer kept up when the bell was sounded.

Three subjects were used for the first group (B-2-a) in which the vibration was visible, and three for the second group (B-2-b) in which the vibration was invisible. The sittings were continued until the limit of improvement had apparently been reached—for this group, for about 30 sittings.

The results of the experiments with the bell were inconclusive. There was no appreciable difference in either rate or amount of readjustment. In fact the individuals in group b, who did *not* have the objective assurance that the sight and sound belonged together, showed on the average a slightly higher rate and amount of improvement than those in group a. Their average 10 day remainder was only 8 cm., while the corresponding remainder for the three in group a was 9.5 cm. The results of both groups were indeed strikingly like those for B-1.

After the experiments with the bell (B-2) two more subjects

were tested out for 10 days in the B-1 series with the buzzers. Both of these subjects (R. and H. E. C.) showed a very small amount of readjustment, their remainders for the 10-day period being 14 cm. and 12 cm. respectively, and the per cents of readjustment only 27 and 32. This brought the average in group B-1 so low that on comparing the two groups as a whole, we find a far less significant difference between the standard and the sound groups than had appeared before. The superiority of the sound group over the standard group was by these two additions reduced in regard to the 10-day remainder from 24 per cent to 14 per cent and in regard to the 10-day readjustment from 26 per cent to 18.5 per cent. It is a question whether the small per cent of improvement of these two subjects does not indicate merely a lack of general susceptibility to readjustment, an individual peculiarity that certainly exists. Unfortunately their sittings did not extend beyond the tenth, and so there is no way of telling whether, like O. B. B. in the standard group, they might have shown a spurt of progress later on.

The individual and group results for all 3 of the B groups are given in Table IV. The results for B-2-a (vibration visible) and B-2-b (vibration invisible) are combined after B-2-b, since there is no esesntial difference between them.

The figures for auditory accuracy reveal a good deal of individual consistency considering the relative crudeness of the arrangements. While there are wide limits of variability among the different members of the group, the average mean deviation for the group for all four positions being 6.3 cm., the individual variability is less. The highest mean deviation for any individual is 5.1 cm., while the lowest is 3.6 cm. The distance between the four different positions of the buzzers, it will be recalled, is 13 cm. All of the subjects, therefore, were able under normal conditions not only to distinguish by sound alone the four different positions, but within this range of 13 cm. quite accurately to localize the particular source of the sound.

Under the conditions of distorted vision the great majority of the subjects were conscious as soon as the sittings started of the approximate actual position of the sound. In general they re-

TABLE IV

Results for Three Auditory Groups.

Subjects	No. of Sittings	Visual Acc. 53	Visual Acc. 66	Visual Acc. 79	Visual Acc. 92	Auditory Accuracy 52	M. Dev.	66	M. Dev.	79	M. Dev.	92	M. Dev.	Av. M. Dev.	A.L.D. 1st 5 trials	Rem. 10 day	Rem. Total	Per ct. Readj. 10 day	Per ct. Readj. Total
B-1																			
F.D.	25	52.4	66.0	79.5	93.0	56	4.2	69.5	5.1	85.0	4.5	96.0	3.0	4.2	16.7	8.8	3.6	45	66
A.C.W.	19	55.0	68.7	82.0	94.0	68	3.6	80.0	3.4	86.0	3.0	94.0	3.4	3.6	18.9	12.6	6.4	33	66
R.D.	23	53.1	66.0	78.6	91.6	44	5.9	58.0	4.3	72.0	4.4	89.0	3.1	4.4	15.7	4.8	1.2	70	100
H.S.	13	52.8	67.2	79.8	92.3	45	4.6	53.0	5.5	63.0	4.9	75.0	5.4	5.1	22.2	12.9	11.5	42	49
R.	11	54.1	66.9	79.5	91.9	53	3.7	69.0	4.6	81.0	4.0	93.0	4.3	4.4	19.4	14.2	14.2	27	..
H.E.C.	11	55.9	68.3	79.9	92.5	58	..	68.5	..	79.0	..	90.4	..	..	17.1	11.6	11.6	32	..
Average	20					54	4.4	66.0	4.6	77.7	4.5	90.0	3.8	4.3	18.3	10.8	7.7	41.5	73
B-2-a *Visible*																			
H.K.	11	54.6	67.4	82.7	91.8	..	..	...	..	...	..	...	..	..	18.6	14.3	14.3	23	..
C.W.L.	45	55.4	66.4	80.4	92.3	..	..	...	..	...	..	...	..	..	21.7	7.9	4.2	64	81
M.M.	40	50.6	65.1	77.8	91.3	..	..	...	..	...	..	...	..	..	22.6	10.3	3.6	55	88
Average	32														21.0	10.8	3.9	59	84
B-2-b *Invisible*																			
K.E.L.	31	53.1	66.8	79.8	92.4	..	..	...	..	...	..	...	..	..	21.4	5.2	3.8	76	82
F.L.B.	25	54.5	68.2	80.0	94.5	..	..	...	..	...	..	...	..	..	15.3	3.3	1.3	79	91
C.S.	25	54.1	65.6	79.7	91.6	..	..	...	..	...	..	...	..	..	15.4	7.4	.2	52	99
Average	27														17.5	5.3	1.8	69	91.0
Av. B2	29.5														19.6	8.0	2.8	64	87.5

ported that it seemed at each trial to be to the left of the buzzer, estimating the distance to be from 6 to 30 cm. from its apparent position. Subject C. S., in group B-2, is the only one who thought for a while that the sound was to the right, but she soon discovered her error.[1] Subject M. M. (group B-2) is the only one in the series (including 15 subjects) who did not at any point in her sittings localize the sound as to the left of the apparent position of the object.

In considering the remainders and per cents of readjustment in the sound series it will be convenient to deal with the group results. In Table V, p. 58, is a summary of the results by groups of A-1, the standard group of seven subjects, using four buzzers; B-1, the first sound group of six subjects, using one buzzer; and B-2, the second sound group of 6 subjects, using the bell. The

TABLE V

Summary of Group Results for Series A and B

Group	No. Subj.	Av. L.D.	R. 10-da.	R. Total	Sittings	Per cent Readj. 10 da.	Per cent Readj. Total
A-1-a	7	19.1	12.5	8.7	21	35	56
A-1-b	4	17.7	10.6	9.1	22	38	(47)
B-1	6	18.3	10.8	7.7	22	41.5	(73)
Improvement of B-1 over A-1			13.6%	11.5%	1	18.5	(30.3)*
B-2	6	19.6	8.0	2.8	29.5	64.0	87.5
A (1-a and 1-b)	11	18.4	11.5	8.9	22.0	36.5	(47)*
B (1 and 2)	12	19	9.4	5.3	25.7	52.7	80
Improvement of B over A			17.2%	40%		44%	(70%)*

* For four subjects only.

[1] Toward the beginning of her sittings, C. S. even reported at one time that she "saw the experimenter in one place and heard her voice in another" (to the left). It is of interest here to note that M. O. W. (in series A-2) first discovered the direction of the prismatic deviation through noticing a similar discrepancy between the sound of the experimenter's voice, and her position as reported by sight.

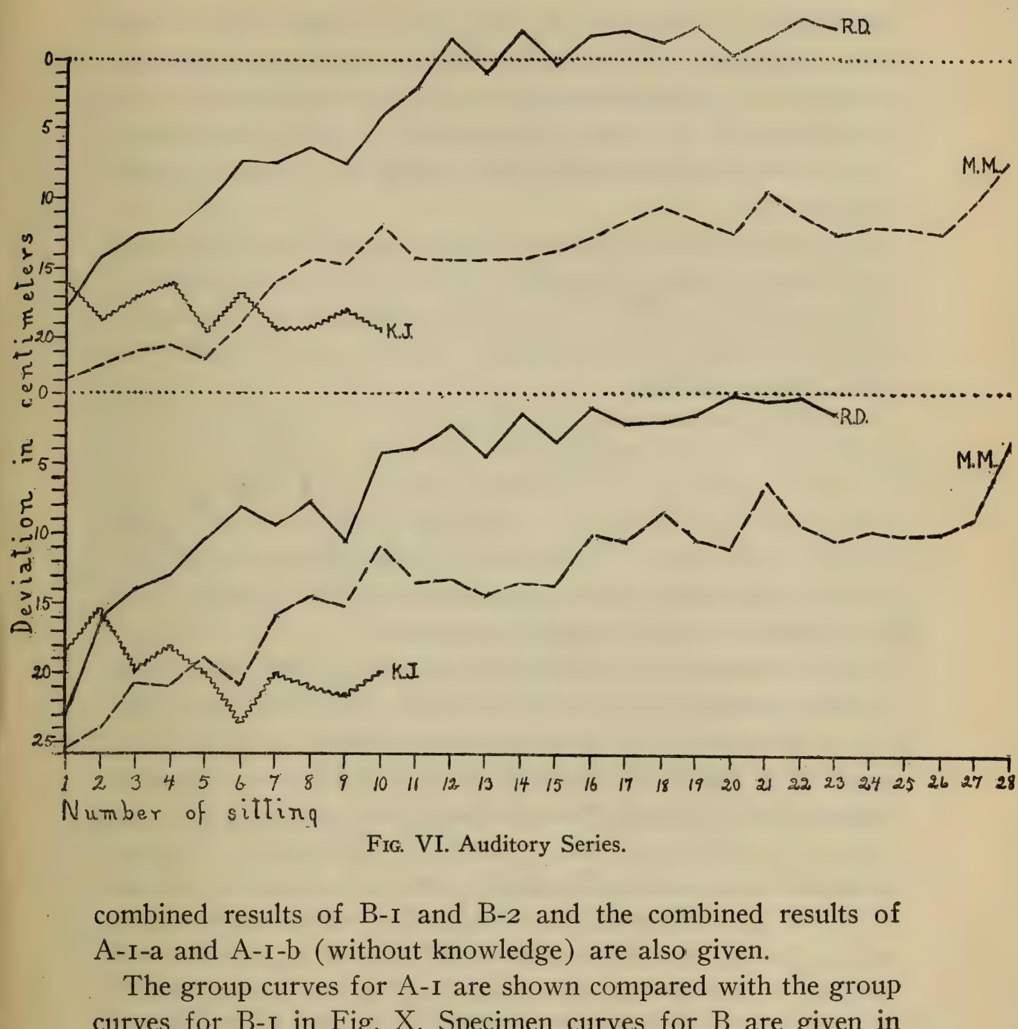

Fig. VI. Auditory Series.

combined results of B-1 and B-2 and the combined results of A-1-a and A-1-b (without knowledge) are also given.

The group curves for A-1 are shown compared with the group curves for B-1 in Fig. X. Specimen curves for B are given in Fig. VI.

From an inspection of these tables and curves it will be seen that there are some indications that sound is an influential factor in the process of readjustment. Comparing group B-1 with the standard group in which the buzzers were not sounding, we find for the 10 day period a remainder less by 13.6 per cent than that for the standard group, and a per cent of improvement 18.5 per cent greater. If we combine the results for A-1 (with knowl-

edge) and A-2 (without knowledge), and compare them with the combined results for B-1 (using buzzer) and B-2 (using bell), we find a still greater difference. The 10 day remainder for the sound group is now less than that for the standard group by 17.2 per cent. The amount of readjustment for 10 days is greater by 44 per cent.

Now while these differences, considering the large amount of individual variation, by no means justify even the positive conclusion that the sound had any influence at all in forming the new coördination, they certainly do indicate the probability that sound may be a factor.

An indication that sound as employed in our experiments may be a factor in the formation of the new coördination, is the fact that some subjects report that they feel a positive "pull" in the direction of the sound, or in other words, toward the actual position of the buzzer. A. C. W., for instance, in his later sittings, felt such a tendency. Localizing the buzzer as it appeared to be, he described as like "pushing up stream."

This consideration is offset by the fact that a majority of the subjects not only felt no "pull", but paid very little if any attention to the sound. The report was common that the sound served merely as a signal for reacting, or as a sort of "orchestral accompaniment". Several, though they always localized the sound —as to the left—felt that it made no difference in their reactions. The most striking negative evidence occurs in the case of M. M. (group B-2) who, though she made steady progress and finally made a readjustment of 88 per cent, reported that she was not at all conscious that the sound was to one side of the buzzer, and did not even know until the very last the direction of the distortion. (See M. M's curves in Fig. VI.).

One subject, K. J., localized the sound as to the left, and mentioned noticing it frequently. It was impossible to get him to adopt a naive attitude toward the experiment, and it was quite evident that he was determined to resist the suggestion that occurred to him that the sound was expected to influence him, as these typical remarks indicate: "Of course you realize the sound doesn't make a particle of difference," and "Why are you

sounding the buzzer at all?" In K. J's curves given in Fig. VI we see an actual progressive regression from the actual position of the buzzer, a unique situation among the 72 subjects. It seems plausible that the regression may be due to the unconscious influence on the localizations of the stubborn determination not to be influenced by the sound.

As a matter of fact, suggestive as the above reports of subjects are as to the factors which did or did not influence them, they have not a particle of value as scientific evidence. A subject might be sure, as M. R. G. was in series A, that he was reaching to the same point each time, and yet actually be steadily advancing to the left, influenced by factors of whose existence he was entirely unaware. Similarly, subjects who reported that they paid no attention to the sound may nevertheless have been influenced by it, just as people may respond to irritating stimuli during sleep, or waken if an accustomed stimulus ceases.

An attempt to see whether the sound might cause additional readjustment after a subject had reached the limit of improvement in the standard series, proved fruitless as far as gaining definite evidence was concerned. This is what might have been expected, for as has been pointed out, it had been found that some subjects in the standard series whose curves remained on a level for some time, showed unexpectedly new progress in readjustment. The fact, however, that four out of the five subjects tested in this way did show at least a slight improvement immediately after the introduction of sound, is worthy of attention. The subject whose curves exhibited no change whatever on the introduction of sound was M. W., the writer, who was, it happens, the only one in the standard series who showed no progress in that series. The improvement shown by M. R. G. and D. S. is only what might have been expected had no change in conditions been made.

In series A-2, however, the increase in readjustment of M. O. W. and of M. Mc F., after the introduction of sound, seems possibly significant. The curves of M. O. W., which after 28 sittings had remained on a level for six sittings, showed an average rise of 2.5 cm. in the first sitting in which sound was given. In

the next 16 sittings the per cent of readjustment increased from 37 to 45. The curves of M. McF., which after 35 sittings had remained at a level for 10 days, showed a slight rise during the three days after the introduction of sound (an average rise of 3.4 cm.). There was then a slump due to a fortnight's vacation and a 10 days' absence on account of illness, after which the curves showed a steady rise for nine days and a total advance over the record for the sittings without sound, of 34 per cent in amount of readjustment, while the remainder decreased from 8.6 cm. to 4.2 cm.

Such facts as the above may well make us hesitate before concluding that sound has no efficacy in our experiments. Another aspect of the situation is this: Inasmuch as subjects in the standard series have shown a great deal of individual difference in susceptibility to whatever factors make for improvement, may it not be that some subjects are influenced by the sound and others not? May not the unusually rapid progress of R. D. and of C. S. be correlated with their interest in the sound and its location, while others are not similarly influenced? Here of course the influence of sound, if there be any, may be said to consist merely in the emphasis of the direction and amount of distortion. The situation is so complex, and there are so many possible factors that it is in fact impossible to conclude from the slight evidence we have, that sound is efficacious in these two cases.

Even if sound does have some influence in the process of readjustment, it is clear that in our experiment, that influence is slight, and not susceptible of quantitative measurement. As an illustration let us take the case of R. D., who showed a readjustment of 100 per cent in 12 sittings. From an inspection of her curves in Fig. VI, it is seen that for 10 days after attaining an approximately correct localization of the buzzers, the curves fluctuate about the same general level. Now if it were the sound of the buzzers that was determining her localizations, the average for these 10 sittings should roughly coincide with her average normal auditory localization. But as a matter of fact R. D. localized the sound of the buzzer normally over 6 cm. to the right of its actual position. (See Table IV.) While the sound may have influ-

enced her, then, it was not by virtue of exerting a definitely measurable "pull" toward a certain particular position.

In this connection it is pertinent to note the fact that while the exact localization of the sound is unstable and shifts within rather wide limits, it is for the great majority of the subjects at first a relatively independent matter. At the begining of the sittings the sound is clearly assigned to a position definitely to the left of the object as seen. It is only as the sittings progressed and readjustment took place that the discrepancy between sound and sight was reported as becoming less. Many of the subjects reported that at the close of the sittings sight and sound seemed to be at last together, and the finger to "feel" in the right place too.

Now while the sound comes finally in the process of readjustment to be "pulled over" to the sight, the subjects were not so suggestible on this point as some of Stratton's observations might lead one to expect. The localization of the sound in our experiments is a relatively independent matter, changing only gradually in response to the demands of the practical situation.

The following conclusions may be drawn from the experiments on sound in series B:

1. There is evidence that sound may have a slight influence in the formation of the new spatial coördination developed under the conditions of our experiment, especially for some subjects.

2. If sound does have an influence, this influence operates in general without awareness of that fact on the part of the subject.

3. The fact of perceiving or not perceiving the direct connection of the sound with the vibrating visual object, has under the conditions of our experiment no influence on the rate or amount of readjustment.

4. The conditions of our experiment are not definite enough, especially in the matter of directions to subjects, to insure a fair test of the efficacy of sound as a factor in the formation of the new coördination. There is need for a better experimental technique in this matter.

LOCALIZATION WITH TOUCH

The next series, C, was designed to determine the influence of contact with the buzzer upon the rate and amount of readjustment to the changed visual conditions. For this series one buzzer only was used. This was shifted from one of the four positions to another according to a regular order. The slit at the back of the cover was widened just enough to permit of lowering the buzzer half way down through it. The subject, on making a correct localization, would thus touch the lower half of the buzzer without seeing his finger. The contact with the relatively cool smooth buzzer was distinctly different in quality from the usual contact with the wood forming the back of the apparatus.

Contact was the sole means of determining the actual position of the buzzer. It was not sounded. The localizing finger could not be seen by the subject even though the slit was wider than in the preceding series, because the narrow wood strip one cm. in thickness (which formed the front of the frame supporting the sliding cover) acted as a sort of screen. As in the preceding series, in order that the subject might not find out the extent of his error by visual means, through seeing the experimenter's movements in getting the records, the black curtain was drawn after each localization.

1. Passive Touch, as the Result of Chance Success

In the first group of experiments with touch the subject localized the buzzer exactly as in the standard series, reacting to its apparent position, but with the knowledge that when he made an objectively correct localization he would touch the buzzer. In other words he knew each time he reached out that he was missing the buzzer. There would be no actual contact with the buzzer, then, unless by accident or until almost complete readjustment should occur.

In the case of the three subjects in this group, it was found that the knowledge each time that the localization was wrong, had apparently no effect upon the rate of readjustment. The results were in all respects like those of the standard series. (See

Table VI.) Complete readjustment occurred in the case of only one subject. In his case it was plainly due to an accidental direct con-

TABLE VI

Groups C-1 (Active Touch) and C-2 (Passive Touch)

Subjects	No. of Sittings	Visual Acc. 53	66	79	92	Av.L.D. 1st trial	Rem. 10 da.	Rem. Total	Per Cent Readj. 10 da.
C-1									
T. L. W.	18	53.5	66.5	80.6	93.7	13.	+1.4	+1.4	90.
M. K.	10	53.9	65.8	78.3	91.0	21	18	..	14
R. J. B.	20	54.1	66.8	78.6	91.2	22.3	19.3	19.3	13
C-2									
F. D.	11	53.4	67.0	79.9	92.4	24.9	.5	..	98
D. B.	13	55.0	67.6	81.0	94.0	23.4	3.4	2.0	85
M. B.	10	53.0	66.0	79.7	91.9	19.1	.23	..	99
G. B.	12	52.8	66.8	79.3	93.0	20.4	1.0	.55	95
F.	10	53.9	66.6	80.0	92.2	21.2	.96	..	95
Average	11						1.02		94.4
R. D.	9	53.2	66.0	78.3	91.7	8.4	10.2	..	45

tact with the buzzer. The other two did not approach sufficiently close to the buzzer to admit of the occurrence of a chance touch. One of these subjects, R. J. B., was one of the few of the entire number of 72 subjects who, like M. W. in the standard series, made no significant progress at all, although she had 20 sittings. The results for this group, then, were indeed essentially like those of A-1, and served only still further to confirm the conclusions drawn from them.

The results of one subject of the three, however, furnish a bit of interesting evidence. T. L. W. *accidentally* touched buzzer four, at position 79, at the first localization in his fifth sitting. As a result all the following localizations were much nearer the actual position of the buzzer, although T. L. W. *was not conscious of the change*. (See T. L. W.'s curves in Fig. VII.) The curves for all the positions, which had for the four sittings shown no advance at all, rose after this *one* contact experience an average of 6. 1 cm. in the one sitting! Moreover, the influence of the contact was strongest for the particular position where it occurred, (buzzer 3) and least for one farthest away (buzzer 1). At the end of the 10th sitting there was complete recovery for buzzer 3, but

for buzzer 1 recovery was not complete until the 18th sitting. All this regular and rapid readjustment took place while T. L. W. was reacting automatically to the position of the buzzer *as it appeared to him!*

The case of T. L. W. shows in a striking way the marked efficacy of direct contact as a factor in readjustment. But it is plain that with the instructions used in this group, direct contact would occur only rarely, in the case of a few subjects.

The results of the group as a whole show only that the objective knowledge of error, when contact was not felt, had no effect in hastening readjustment. This is significantly in line with the results of Series A-1-b (without knowledge).

2. Active Touch, as a Check at Each Localization

In the next series the aim was to test the influence of the factor of active touch as a check at each localization. For this group the subject reacted, as in all the series, to the *apparent* position of the buzzer. But after each localization made in that manner, he checked the accuracy of his localization by actual contact, according to the following directions:

"When you have touched the board, keep your finger in position while the screen is adjusted and until the experimenter says 'All right.' Then, not taking the finger from the board, move it along until you touch the side of the buzzer. Then put your finger tip squarely on the black line as it extends beneath the cover. Now sit back in the chair and wait for the next 'Ready' signal."

After the first localization the subject would move his finger uncertainly along the board, as often in the wrong direction as the right one, and would usually not touch the buzzer until after some retracing. After this there would be, *after* each localization, one natural movement in the right direction, leading to the contact experience. Of course with this revised procedure we do not have as the additional factor a simple contact value, but one complicated with kinaesthetic stimuli. In other words we have active or exploratory, rather than passive touch.

In dealing with the results of series C, D, and E we must keep in mind the fact that in these groups, as pointed out in the dis-

cussion on pp. 18 and 19, the per cent of readjustment is a less reliable measure of improvement than in series A and B. This, it will be remembered, is due to the fact that in these later series the readjustment occurs so rapidly as to make extremely ambiguous the figures expressing initial linear deviation.

An illustration from series C-2 of the fact that readjustment takes place within the first four trials is afforded by the results of D. B. From Table VI, p. 64, it is seen that her initial deviations for positions 53, 66, 79, and 92 are 24, 23.1, 27, and 19.5 cm., respectively. Now according to the linear deviation calculable from trigonometric formula on the basis of the angle of the prisms and the angle at each of these positions,[1] the greatest deviation should be at 53, and the amounts should be successively less for the other buzzers. The fact that instead the order of greatest deviation is 79, 53, 66, and 92, is easily accounted for by the fact that the trials were given in just that order. Thus for each successive trial we have a decrease in deviation, due to the tendency to readjustment—a decrease so marked as to obscure the common objective difference in linear deviations due to angle and position.

The individual results for series C are given in Table VI, and specimen curves in Fig. VII. In the table a plus sign before a remainder indicates that it represents "over-correction", or localization to the *left* of the actual position of the buzzer. The curves for four of the five subjects in group C-2 exhibit a uniform and gradual, but very rapid readjustment. On the average the remainder of these subjects at the end of the 10th sitting is only 1.02 cm., and the per cent of readjustment is 94.4. One subject, R. Dixon, is a notable exception. Apparently touch is not effective in her case at all, for her very lowest remainder is 10.2 cm., and after that point (at the sixth sitting) her curves recede again until at the ninth sitting they are nearly as low as at the beginning.

These results are decisive evidence that touch is a powerful factor in the formation of the new habit of spatial reaction. That one subject was apparently not influenced by this factor, only indicates again the existence of marked individual differences in

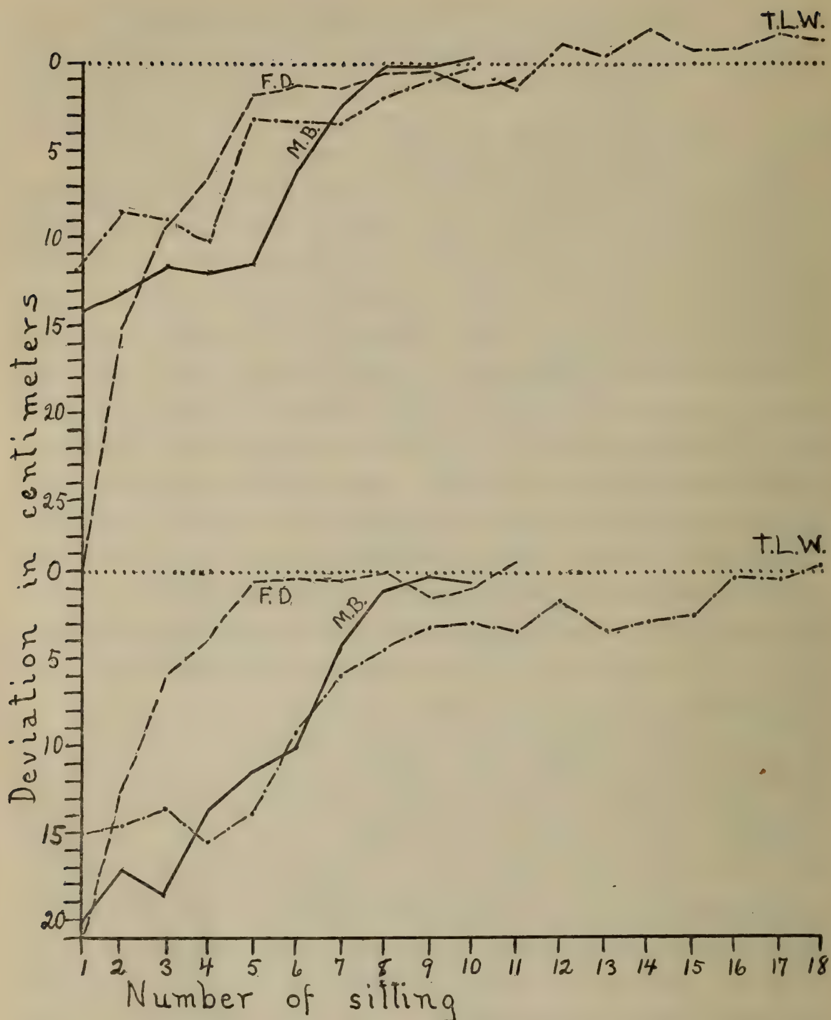

FIG. VII. Tactual Series.

[1] $b = \frac{c \sin B}{\sin C}$. See p. 42.

the matter of adjustment to spatial relations. The gradual slope of the curves, the striking correspondence for each subject of the curves for the four different positions, and the general similarity of the curves of the five subjects who did readjust, all

point to the operation of a consistently powerful stimulus to readjustment.

The fact that the readjustment did not occur on a conscious level needs to be emphasized here. At each trial the subject reached out naturally and automatically toward the buzzer *as it appeared to him.* There was, after each localization, the knowledge that the actual object had been missed, and the awareness through previous tactual-kinaesthetic experience of its approximate location. But since there was no conscious attempt to correct, the "re-harmonization" evidently took place in response to a need for a practically effective response, of which the subject himself was not clearly aware.

LOCALIZATION WITH VISUAL PERCEPTION OF AMOUNT OF DISTORTION

The aim of series D was to determine the relative influence of sight of the localizing finger after the response, in the formation of the new spatial coördination. For this series the slit at the back of the cover was made wide enough to permit the introduction of the finger tip when a localization was made, in such a way that the tip only of his finger was visible to the subject. At the same time the buzzers were raised to such a height that the finger tip, when appearing just beneath the black line, did not come in contact with the buzzer. All four buzzers were used. Instructions and general procedure were exactly as in the standard series. Thus by having the subject react to the apparent visual position of the buzzer, we were able to test the effect of visual perception of the amount and direction of error.

Ten subjects took part in this series. The results are given in Table VII, p. 67, and Fig. VIII. The results of E. B., M. L. P., P. and P. I., while given in the table, are not included in the general averages for the group. This is because they had less than 10 sittings and did not quite reach complete readjustment. In this table, as in Table VI, a plus sign before a remainder indicates an excess of localization to the left.

It was perhaps more difficult in this group to maintain a per-

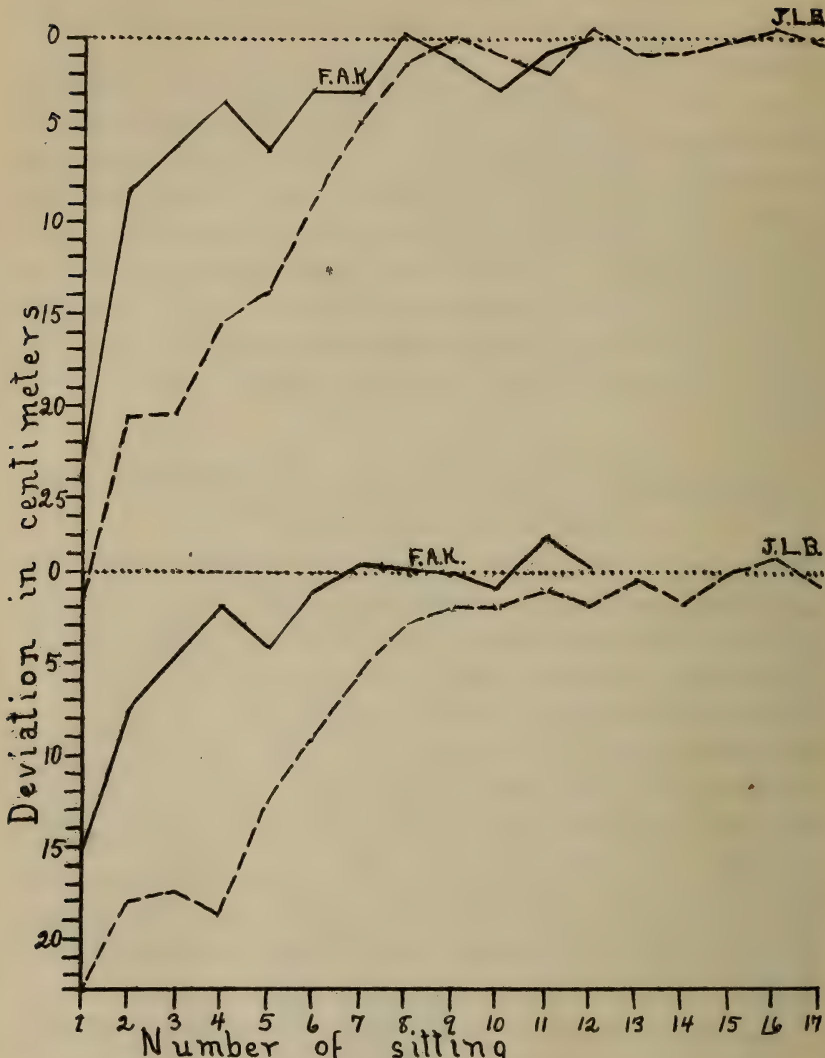

FIG. VIII. VISUAL GROUP.

fectly naive and uncritical manner of response, with no conscious effort to correct, than in any other series. But there were more subjects, and more highly trained subjects, in this group than in any other group. They all reported that the process of readjustment was purely effortless and they were uniformly surprised when the distance from the buzzer first began to decrease. That

the process was spontaneous and automatic is indicated by the strikingly gradual slopes of the curves and their uniformity for the four different positions.

The curves of all 10 of the subjects in this group show a very rapid readjustment, amounting in 10 sittings to an average per cent of readjustment of 97, with a remainder of only .4 cm. This shows that in our experiment, vision and touch seem to be almost equally powerful factors in effecting a readjustment to the new spatial conditions. The curves for the groups (C and D) in Fig. X exhibit about the same general height and slope.

A study of both the curves and tables, however, reveals significant differences. In the first place the group curves seem to indicate that the *rate* of readjustment is more rapid for series D than for series C. The curves for the sight series, D, are consistently higher on the average than those for the touch series, C. Especially striking is the difference for the first two sittings. On first thought this would seem to indicate a more rapid initial readjustment for sight than for touch. The numerical results in Table IX, p. 73, however, suggest that this may not be really the case, and that the average amount of deviation is so much less in the case of sight, not because there was a good deal more progress within the first sitting, but because the average *initial* deviation for the group was less by 4.5 cm.

But why is the average initial deviation so much less than in the case of the sight series? There are two possible reasons. First, it may be due to mere individual variability and the lack of a sufficient number of cases to strike a typical average. There are only ten subjects in Group D and seven in Group C. Second, it may be due to so rapid a readjustment in the case of the sight series that the average deviation for the four buzzers combined may be significantly less than the deviation for the first buzzer localized in the sitting, which was in this group buzzer 92.

Now as a matter of fact the second explanation proves on analysis of the results to be the true one. While the average deviation for all four buzzers is 17.6 cm. for the sight series, the deviation for buzzer 92 is 21.3 cm. for the group, a difference

of 3.7 cm. Had the first buzzer to be localized by the group been 53 or 66, this deviation would have been still greater, owing to the fact that the standard objective deviation for buzzer 92 is the least of the four buzzers. The average *initial* deviation for the other three buzzers is markedly less than for buzzer 92, because the process of readjustment set under way by the first localization of buzzer 92 is already proceeding rapidly.

Taking these facts into consideration it is clear that the average deviation for series D, which is calculated on the basis of the average of the initial trials only for each position, is smaller than that for series C for the reason that there is indeed a very rapid readjustment within the first four localizations in the first sitting. Individual variability might account for a small amount of difference in the average initial localizations for the two groups, but it could not possibly in itself account for the striking difference we actually find.

The second significant difference between the results for the sight and the touch series is found in the fact that not only is the rate of readjustment for the former greater, but the absolute amount of readjustment effected within the given 10 day period is greater. The average remainder for the visual group is only .4 cm., as contrasted with 1.02 cm. for the tactual group. (Table IX.) In the visual group four out of the seven subjects who took 10 sittings showed a complete readjustment, while not one of the seven subjects in the tactual group effected a *complete* readjustment. Another indication that the influence toward readjustment afforded by the sight of the discrepancy was more strongly operative than the tactual factor, is the circumstance that in the visual group five out of seven subjects show a small average "over correction" (.15cm.) while no individual in the tactual group showed an average "over correction" for the four positions. It is as if, having felt a strong impetus toward readjustment, the subjects in the visual group were carried a little way past the goal by the mere force of inertia.

We had the opportunity to find out whether sight was a more powerful factor than touch in the case of one individual, owing to the fact that after a long series of sittings with touch (19)

she showed absolutely no further improvement. The factor of sight was then substituted for that of touch with the result that an immediate improvement set in, and after 13 sittings the subject (M. W., the writer) had made a complete readjustment.

A comparative study of the results for series C and D, then, indicates that the factor of sight as used in our experiments is more efficacious in the formation of the new coördination than the factor of touch.

TABLE VII

Visual Perception of Amount of Distortion

Subjects	No. of Sittings	Visual Acc. 53	66	79	92	Av.L.D. 1st trial	Av.Rem. 10 days	Total Per Cent Readjust.
J. L. B.	17	53.3	66.0	78.9	92.2	20.4	1.4	93
P. J. R.	10	53.8	66.1	78.7	91.6	16.0	2.3	86
G.	10	53.0	66.3	79.0	92.0	20.0	.2	100
A. D. U.	12	52.7	66.5	98.8	91.3	15.2	.2	99
D. H. B.	6	53.6	66.2	79.3	91.8	14.5	.15	101
F. A. K.	11	52.7	66.3	79.	91.2	17.3	.1	100.1
F. R.	8	52.5	66.9	78.8	91.5	19.8	.1	100
Average	10.6					17.6	.4	97
E. B.	7	53.4	64.6	78.1	91.9	18.7	.5	97
M. L. P.	6	53.5	65.0	78.2	93.5	16.2	.4	97
P. I.	7	53.1	65.2	78.6	92.3	13.4	1.1	92

LOCALIZATION WITH TACTUAL-KINAESTHETIC CLUES FROM LEFT ARM

Perhaps one of the strongest habitual simple space coördinations employed in daily life is the coördination between right and left hand and arm movements, so necessary for grasping and handling objects. Were some form of this coördination broken up by the wearing of the prismatic glasses, it would seem that there would be an unusually strong tendency to re-form the coördination under the changed visual conditions. It was the aim of series E to see what is the relative strength of this tactual-kinaesthetic influence toward readjustment as compared with the other factors investigated.

The procedure was as follows. The subject was seated at the apparatus in the usual position, wearing the glasses. While his eyes were closed his left arm was extended out *over* the cover by

the experimenter, and he was directed to bend the left index finger so that it would extend downward at the back of the apparatus through the slit, which had been sufficiently widened for this purpose. When his finger was in position the subject was permitted to open his eyes. He was then directed to localize his left index finger as in the normal series, by a direct movement of the right index finger to the part of the left finger extending beneath the cover. He was, as in the other series, to localize the finger as it was visually perceived, disregarding the fact of distortion. The experiment thus tested the influence upon localization of clues as to the correct position of the finger derived through the tactual and kinaesthetic senses.

The slit was so wide in this series that in order to prevent sight of the localizing finger by the subject it was necessary to provide a movable cardboard strip to cover the movements of the finger. In the middle of this strip, which is 56 cm. long and 8 cm. wide, is an aperture shaped like a half moon through which the left finger of the subject was extended. At each trial this opening was set at the desired position, 53, 66, 79, or 92, as the case might be. The same order and number of trials and the same length of interval were maintained as in the other series.

With this manner of procedure the subject was kept just as much in ignorance of the direction and amount of the distortion as in the standard series. The only difference was that in this series tactual-kinaesthetic sensations from the left arm afforded clues to the actual position of the object. Had the subject been permitted himself to extend his left arm over the cover and his finger down through the aperture, he would have gained not only knowledge of the nature of the distortion but practice in overcoming it. It was for this reason that the experimenter put the arm of the subject in place herself, and was very careful that the subject should withdraw it while his eyes were closed and the curtain still in place in front of the line of localization.

Six subjects served in series E, for 10 days each. Results are given in Table VIII, p. 71 and Fig. IX p. 69. The most striking feature of the data is the fact that for all of the subjects the

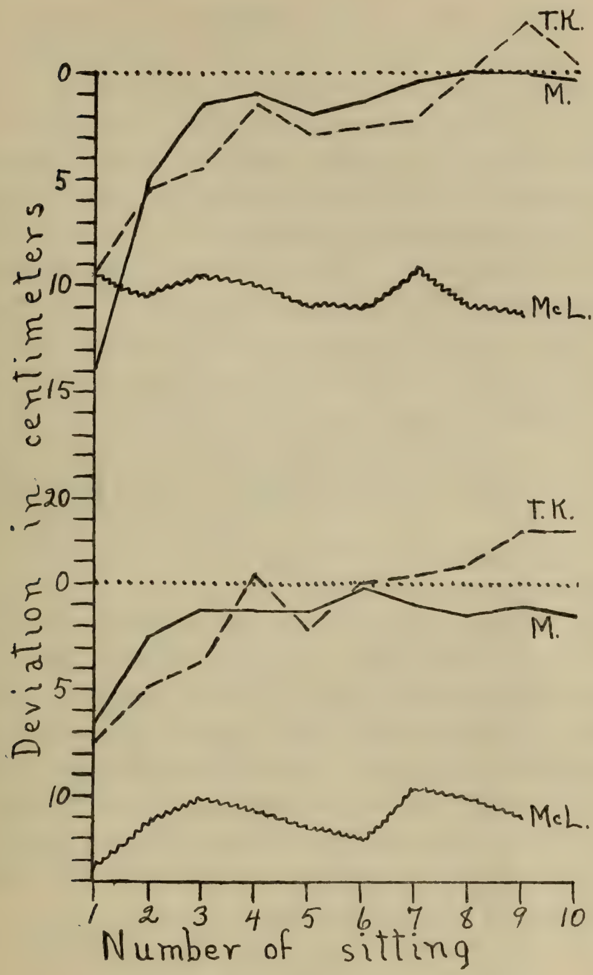

FIG. IX. Tactual-kinaesthetic Series.

initial linear deviations are very much lower than in any of the other series. The average linear deviation for this group is only 9.5 cm., while the lowest average for the four other series, that of series D, is 17.6 cm. The average even for the first position localized, 92, or buzzer 4, is only 10.3 cm. This fact can apparently mean only one thing, viz., that the tendency to effect a practical coördination of the movements of the two hands is so strong that it is impossible with our glasses to break it up, although the sub-

jects acted in innocent and even ignorant good faith in trying accurately to localize the left finger *as it visually appeared to them.* In other words, "readjustment" to the changed visual conditions is on the average more than 50 per cent effective prior to the first localization. Moreover, since the subjects reported that they were unaware of the direction of the distortion, this "readjustment" was unconscious on their part and occurred solely on the basis of the retention of habitual kinaesthetic attitudes.

In the tactual-kinaesthetic series, it is to be kept in mind that the influence of the sensory incentive to readjustment was operative before the first localization. In the auditory series a similar situation prevailed, since the sound afforded a clue as to the actual position of the buzzer before the first trial was made. In the sound series, however, the influence of such a condition was not apparent, while in the tactual-kinaesthetic series it was very marked. In no other series could the clues be perceived before actual localizing movements began.

A second striking feature of the results peculiar to this particular series is the fact that of the six subjects, three showed no continued improvement over their first deviations, while the other three made exceedingly rapid progress and soon overcame their small initial remainders. In no other series have so large a per cent of the subjects failed to readjust. The conclusion is suggested that there may be much more individual variation in the extent to which this sort of tactual-kinaesthetic factor is effective, than is the case with sight and touch.

Such a conclusion finds support from the consideration of particular cases. Subject T. K., for instance, readjusted very rapidly, attaining almost 100 per cent recovery at the fourth sitting. He then forged on ahead beyond or to the left of the actual position of the finger, showing an average overcorrection of 1.7 cm. before he settled down again to an approximately correct localization. The curves of the other two who readjusted exhibit merely a slight fluctuation about the true position after recovery has taken place.

It is the results of T. H. B. which most strikingly indicate how helpless an individual may be under unusual conditions when

left to depend upon kinaesthesis alone. Having made no readjustment during nine sittings, at the 10th T. H. B. was permitted to reach out to what he thought was the actual position of his finger, making a conscious correction. He felt sure that he could do this accurately, even while wearing the glasses. His first confident move was to localize buzzer 1 (position 53) at 34, or 9 cm. *farther away* than he had previously been localizing it! During 20 repeated trials he was unable to find his left finger, missing it on the average by a distance of 16.7 cm. to the right! Astonished, he came back the next day determined to localize it accurately this time, but only to repeat the performance of the preceding sitting during 12 more trials. It was only when directed by the experimenter to reach out on the *other* side of the finger, that T. H. B. did touch it by accident. After this, he was able to localize it with a fair degree of accuracy.

A comparison of the average results for the three subjects in this series who did readjust, with those of other series, reveals of course a striking superiority in both quickness and amount of readjustment. The curves for series E in Fig. X are higher at every point than those of any other curves. This holds true even for the end of the 10 day period, for on the average an excess of readjustment occurred. While the 10 day remainders for series A-1, B-1, C, and D are respectively 12.5, 10.8, 1.0 and .4 cm., that for series E is + .49 cm., representing a positive extra readjustment. This tendency to overcorrect was soon checked by all of the subjects who showed its influence. The overcorrection,

TABLE VIII

Tactual-Kinaesthetic Clues from Left Arm

Subjects	No. of Sittings	Visual Acc. 53	66	79	92	Av.L.D. 1st trial	Av.Rem. 10 days	Total Per Cent Readj.
T. K.	10	55.6	66.7	80.7	93.6	9.4	+1.7	118
W. M. S.	10	53.8	66.4	79.6	92.2	8.0	.76	91
M. M.	10	52.0	65.3	78.9	91.6	10.0	+.47	104.2
Average	9					9.1	.49	104.6
N. McL.	9	53.8	65.8	79.2	92.0	11.0	9.7	12
R.	10	52.9	66.2	79.0	92.3	15.1	13.0	13
F. H. B.	11	54.5	66.9	80.1	92.9	11.1	9.6	13.6
Average						12.4	10.8	12.9

FIG. X. Group Curves.

then, indicates apparently nothing more than an unusually strong impulse toward readjustment.

In considering this striking superiority of the tactual-kinaesthetic factor it must be held in mind that we have after the first sittings another factor lending its weight to the already strong influence of the tactual-kinaesthetic clues from the left arm. This comes from the fact that as soon as the left finger is accidentally touched by the right arm, we have the operation of the direct contact factor the influence of which was seen to be so great in series C. It is no wonder, then, that after actual contact, readjustment is completed almost immediately.

TABLE IX

Summary of Results for All Series

No. of Series	Factor or Condition	No. of Subjects	Av. No. Sittings	Initial L.D.	Rem. 10 da.	Rem. Total	Per cent Readj. 10 da.	Per cent Readj. Total	Mean Dev. 10 da.
				cm.	cm.	cm.			cm.
A-1-a	Standard with Knowledge	7		19.1	12.5	8.7	35.5	56.0	8.0
A-1-b	Without Knowledge	4		17.7	10.6	9.1	38.8	(47)	10.0
A-1 (a & b)		11	22	18.6	11.8	8.8	36.0	53.0	8.8
B-1	Sound of Buzzer	6		18.3	10.8	7.7	41.5	(73)	10.5
B-2	Sound of Bell	6		19.6	8.0	2.8	64.0	87.5	16.5
B (1 & 2)		12	26	19.0	9.4	5.3	52.7	80.0	15.5
C-2	Active Touch	5	10	21.8	1.02		94.4		3.9
C-1	Passive Touch								
D	Sight	7	10	17.6	.4		97.0		4.3
E	Tactual-Kinaesthetic	3	10	9.1	.5		104.6		9.0

IV

RETENTION OF THE NEW CO-ORDINATION

The question as to how long the new spatial coördination will be retained, while not strictly pertinent to our main problem of determining the relative influence of the various constituent fac-

tors, has nevertheless some bearing on the problem, since it concerns the stability of the new habit.

We made no effort systematically to investigate the amount of retention in these experiments, or its relation to time of acquisition or the sensory factors concerned. But some weeks after the conclusion of the experimental series we gave one sitting each to such subjects as were still available—seven in all.

The trials were given in the same manner as in the original sittings. The average of the five trials for each position was taken, and the amount of readjustment shown was calculated. This was compared with the previous highest amount of readjustment to show the per cent of retention of the habit.

The results are given in Table X. Some individual cases of retention are striking. The per cent retained by K. E. L., after an interval of 37 weeks, was 77. That of D. S., after 24 weeks, was 90. The most striking case of all, however, is that of H. L. K. After an interval of two years and three months she was given first the test for visual accuracy, without the glasses. In this test her error to the left of her previous normal standard of visual accuracy was 3 cm., with an average deviation of only .9 cm. On taking the 20 trials while wearing the prismatic glasses H. L. K. showed a retention of 47 per cent of the progress made two years before. Considering the fact that H. L. K. had originally only 12 sittings, this amount of retention is striking.

The results for all of the subjects who took the retention test point, then, to a high degree of stability and persistence in the new spatial coördination.

TABLE X

Retention

Subject	No. of Sittings	Series	Approx. No. of Weeks' Interval	Original Per Cent Readj.	Later Per Cent Readj.	Per cent Retention
D. S.	15	A-1-b	24	57	51	90
T. K.	10	E	24	118	105	89
M. L.	6	D	30	97	78	30
T. L. W.	18	C	24	78	100	78
K. E. L.	31	B	37	82	63	77
H. L. K.	12	A-1-a	116	53	25	47
E. B.	7	D	30	97	86	88

V

DEGREE OF SPECIFICITY OF THE NEW CO-ORDINATION

Does the new spatial habit acquired by the subjects in this experiment carry over to a noticeable extent into normal situations? This question has a general importance theoretically in its bearing upon the whole Kantian and modern controversy concerning the generality of spatial experience. It also has an interest for the narrower purposes of the experimental investigator in the field of space perception. Heretofore the attack on this question has been in general theoretical and to an unfortunate extent controversial. If it should seem possible to throw light on the problem by some such simple experimental procedure as we have employed, then there would be promise of advance in future experimental investigation of the problem.

It proved extremely difficult in this investigation to devise methods that would secure a reliable check on this matter. As soon as we freed the subjects from the rigid conditions imposed at the apparatus in order to observe their behavior in normal situations, we found operating many obscure factors the nature of which it was impossible accurately to evaluate. We believe however that certain tests we used do throw some light on the problem, and give promise that in the future genuinely reliable factual evidence can be secured.

Now if the particular spatial habit we are investigating really does function in general situations, we should find the following conditions to hold:

1. Subjects wearing the glasses at the apparatus should not find the new coördination seriously interfered with should any change in the general sensory situation be made.

2. On the removal of the glasses the continued functioning of the new habit should manifest itself in a disturbance of the old or established manner of reaction. This should hold not only at the apparatus table but for attempts to localize objects in ordinary situations.

3. Practiced subjects wearing the glasses should localize ordinary objects with smaller error than unpracticed subjects.

4. Practiced subjects wearing glasses should be able to walk about a building with more ease and efficiency than unpracticed subjects.

These four general criteria we applied in our investigation. In the first place in order to find out whether a change in the general sensory situation interfered with the new coördination, we adopted the following procedure. For three of the groups at the conclusion of the trials with distorted vision, the chair in which the subject sat was shifted 18 cm. to the right, and localizations were obtained as before with the subject reacting from the new position. Now if the new habit was formed merely on the basis of a definite position, with definite tactual and kinaesthetic stimuli, it might be expected that it would be seriously disturbed or even lost were a new position assumed. The shift in position of the chair, however, made no significant difference in the reactions for any of the 20 subjects who took this test. For five subjects in the standard series, ten in the sound series, and five in the sight series, the average difference between the last five trials for the shifted position is only .3 cm. This small difference is positive, or in the direction in which improvement would be expected. There is, moreover, a negligible amount of individual variation, the difference being very small in every case. Hence the readjustment is general in the sense of not being limited to any particular part of the apparatus.

To answer the second question two different procedures were adopted. First the glasses were removed from the subject immediately at the close of the last sitting with distorted vision. Then, still seated at the apparatus he was required to localize the buzzers *as they appeared to him visually,* in the same manner as before, but without the glasses, and of course without seeing his finger.

If the readjustment had been a function merely of the particular conditions of the practice series, with glasses worn, these localizations with normal vision would have been objectively correct, i. e., the subject would have localized the buzzers with

approximately the same degree of accuracy as in the trials for normal visual accuracy given at the beginning of his sittings.

All of the 23 subjects tested in this way, however, made a large error to the *left* of their standard for normal accuracy. For five subjects in series B, six in series C, nine in series D, and three in series E, to whom the test was given, the average error to the left was 9.3 cm. This means that the subjects, having grown accustomed while wearing the glasses to localizing the buzzers by reaching out some distance to the left of *where they looked to be,* now retained the habit when the glasses were removed, and reached out confidently to the left of where the objects objectively *were.* If the new habit had functioned in full strength without the prisms, then the average error to the left would have been 14.8 cm., the average amount of improvement shown during the sittings by these 23 subjects. That it was in fact 9.3 cm. (or 62 per cent of the original amount) indicates a striking degree of transfer of the new formed habit to the normal situation, considering the strength of the customary or old association between object seen and reaching movement, which on the removal of the glasses would be expected to exert a strong influence.

The other procedure adopted for determining the existence of an after effect from the wearing of the glasses was carried out away from the apparatus. The subject, still wearing the glasses, was seated at an ordinary study table and directed to reach out and touch with the index finger certain objects which lay on the table—an eraser, an ink bottle, and a thimble. This each subject was able to do accurately, after a few trials to overcome the small error to the right that he still made. Now the subject was asked to keep on reaching out, touching the objects every few seconds, and not stopping when the glasses were removed. When he had started localizing the objects in this manner, the experimenter quietly removed the glasses. For two of the four subjects given this test the after effect was striking. These two, T. L. W. and K. E. L., continuing to reach out in the same way, missed the objects each time by from two to four cm. to the *left,* although they could plainly see their hands going in the

wrong direction. They were surprised and amused at the result. Both reported a queer "pull" to the left and a feeling of effort or strain as if something were holding them back. Thus in spite of the existence of a sharp conflict between the established system of localization and the newly acquired space habit, the latter continued to exert an influence in this everyday situation. Moreover it required a number of trials for both subjects before they could again reach out and touch the objects accurately.

For the two subjects whose normal reactions were not thus influenced, it seems that the sight of the arm and hand in reaching out may have supplied an overwhelmingly powerful stimulus to unconscious correction to the right while the movement was still under way. Even for the subjects who did feel the after effects the error was so small that it would have led to no difficulty in making practical adjustments unless movements of great accuracy were required; and it is quite possible that the effect was with them only transitory. None of the other subjects after the removal of the glasses reported any interference with normal reactions.

Even if the after-effect is slight and perhaps transitory, however, this test is significant in showing definitely that even such a rapidly acquired and simple spatial coördination as this may function effectively enough to interfere with the longstanding habits of reaction. It is unfortunate that the test was devised too late to give to a larger number of subjects. Together with the test at the apparatus however it furnishes clear evidence that the new habit does exert an influence on normal reactions.

Our third criterion, that subjects who had learned to localize the buzzers more or less correctly while wearing the glasses, should be able with the glasses on, if the habit is general and not specific, to localize ordinary objects with either no error or a smaller error than unpracticed subjects, we subjected to test in two ways. First, we had the subject sit at a study table, and, wearing the prismatic glasses, localize objects placed in definite positions in front of him. Second, we had him walk about the room, pick up objects, walk down a long hall and the like, while we carefully observed his behavior.

For the test at the study table we first tried the following

plan. Five objects,—two ink bottles of different size and shape, an eraser, a small box, and a thimble were placed in definite positions on the table, about 20 cm. apart, and from 25 to 40 cm. from the edge. The subject, wearing the glasses, was seated in front of these objects, with his right arm resting on the table parallel to the front edge. He was instructed to reach out at a natural rate of movement and localize the object *as it appeared to him* with his index finger. The experimenter first named the object, and then at the signal "go" the subject reached out, letting his finger rest where it happened to fall until the experimenter had noted in centimeters the amount of error to the right.

The first tests given with this method showed it to be unreliable. The errors were found to be very small and to decrease markedly after the first trial. But far from indicating a transfer effect this only showed that a powerful factor was operating within the time of the test to decrease the amount of error. This factor seemed evidently to be the sight of the arm, which, after the reaching movement was started, would serve as a strong stimulus to correction to the left. Such a conclusion is in line with the statement of a number of the subjects that although they tried honestly to locate the object as it looked to them, they felt a strong "muscular urge" or "pull" to the left against which they had to resist.

With the idea of at least partially obviating such a tendency to correct and thus of getting a measure of the transfer effect, we hit on the plan of having later subjects reach out *very quickly* to the object, believing that there would thus be much less likelihood of the direction of the movement being changed, once started.

Twenty-seven subjects took the test in this form. The numerical results for all individuals are given in Table XI, p. 81. Although two trials were given for each object only the first is given here. In practically all cases the error was much less, approaching zero, on the second trials. Since there was considerable variation in the position of the subject's chair, his distance from the objects, and the order in which they were named, these results are a very rough measure only of the relative amount of error, and it

would be useless to attempt to deal with group averages and comparisons. The individual results, however, are worth studying.

The objective errors due to the prismatic distortion would have been from 20 to 35 cm., according to the position of the objects. But the errors shown in the table are very much less. The smallness of the errors however can not be due primarily to transfer. This is shown in the first place by the fact that the error markedly decreased after the very first trial. For example: for the first object the error of E. B. in the Tactual Series is 20 cm. and for the second object only 7 cm. For F. in the Visual Series the error for the first is 15 cm. and for the second 2 cm. Subject F.'s remark, "I feel an irresistible pull to the left," indicates the nature of the stimulus which influenced other subjects though in lesser degree, to decrease their errors. Evidently the sight of the arm in reaching and the visual perception of the discrepancy between object and localizing movement, initiated kinaesthetic impulses so strongly in conflict with the reaction originally released as to modify its direction.

A second type of evidence that the smallness of the errors is not the direct result of transfer of the new space habit, lies in the consideration that there is no apparent relation between the amount of error in this test and either length of practice or the amount of readjustment attained. The results of M. W. and M. K. in the Visual Series illustrate this point. M. W., after 63 sittings and complete readjustment, still made an extremely large error; while M. K., who took only 10 sittings and showed very little readjustment, made much smaller errors, and these were quickly eliminated.

The main indication, however, that the transfer effect is not great in this test comes from comparison with the results of an unpracticed group. Nine students who had heard of the glasses but had never worn them before, were given the same test at the study table but this time with four objects instead of five. From the results in Table XII, p. 81, we might at first glance conclude that the regularly larger errors are due to lack of practice with the glasses. But in the first place it is seen that there is the same decrease with successive trials as in the practiced group, and the

TABLE XI

Initial Errors to Right in Centimeters for Specificity Test at Study Table. No Screen, Quick Reaction.

Group	Subject	Objects 1	2	3	4	5	Number of Sittings	Average Total Rem.
Standard	O. B. B.	9	10	11	14		22	9.5
	W. A. O.	4	4		5		27	3.5
Auditory	C. W. L.	16	12	12	0	4	45	4.2
	F. B.	6	3	0	0	10	25	1.3
	K. E. L.	9	13	9	7	4	31	3.8
	C. S.	0	0	0	0	0	25	.2
	M. M.	14	10	8	10	2	40	3.6
Visual	M. C.	3	4	2	7	3	10	4.5
	F. D.	7	9	4	2	6	11	.5
	D. B.	6	6	4	3	3	13	2.0
	M. B.	2	2	4	2	3	10	.2
	F.	15	2	2	1	0	10	.96
	M. K.	11	12	7	2	18	10	18.0
	T. L. W.	15	7	12	7	3	18	1.4
	R. D.	8	3	6	5	7	10	10.2
Tactual	J. L. B.	13	15	16	12	19	17	1.4
	P. J. R.	7	4	3	4	9	10	2.3
	H. G.	11	3	2	3	4	10	.2
	A. D. U.	9	6	4	4	2	12	.2
	E. B.	5	20	4	7		7	.5
	P. I.	3	7	0	4	12	7	1.1
	J. H. B.	2	13	7	1	6	5	.45
	M. P.	4	4	8	0	0	6	.4
Tactual-Kinaesthetic	T. K.	11	12	11	9		10	1.7
	W. S.	10	12	13	7	16	10	.76
	M. My.	12	4	4	13	14	10	.47

TABLE XII

Errors to Right in Specificity Test. No Screen. Quick Reaction. Unpracticed Group.

Subject	Objects 1	2	3	4
E	14.0	21.0	5.0	12.0
W	12.0	4.0	2.0	6.0
F	9.0	3.0	2.0	9.0
Fl	15.0	12.5	0.0	8.0
R	12.0	13.0	7.5	11.5
Fr	14.0	16.0	0.0	3.0
H	12.0		3.0	11.0
B	12.0	11.0	2.0	4.0
S	18.0	12.0	4.5	16.0
Average	13.3	10.4	2.9	8.9

same individual variation. In the second place it is true that the experimenter with the unpracticed group took more pains to impress on the subjects the point that they were not to correct to the left. In the third place the errors, even though relatively larger than for the practiced group, are still on the average half or less than half what the objective uncorrected error would have been.

It follows then that our second plan for securing a fair measure of the transfer effect was unsuccessful, and that so far there is no clear evidence that the new habit functions in every-day situations.

A third plan was tried after the regular series had been concluded. The experience of the writer, M. W., pointed to a possible source of error in the fact that a more rapid rate of movement was prescribed for the test than the natural rate employed during the original building-up of the habit at the apparatus. M. W. did not complete her readjustment and take the tests with objects at the study table until after practically all the other subjects had finished. She found then that when she reached out very quickly to localize the objects, she missed them on the average by as much as 17 cm. But when later she tried reaching out at a *natural* rate of movement she missed them, if at all, by only one or two centimeters! The same results were obtained at several later times. This suggested that the other subjects may have been making more than their natural amount of error, since the directions had been explicit to move very quickly. Such a conclusion is in line with the work of Woodworth on movement. He found that a simple movement automatically performed at a natural rate, was made with much less accuracy when the rate was greatly increased.[1]

It seemed likely, then, that our test of the generality of the new coördination had not been a fair one. An attempt was made to check the accuracy of this conclusion by giving the test in a modified form to four students who had formerly served as subjects and had attained varying per cents of readjustment.

[1] Woodsworth, R. S. "Le Mouvement." Paris, 1903. Ch. XV.

First, wearing the glasses, they practiced making localizations at the apparatus, with sight of the finger, until a test given by the experimenter showed that they could localize the buzzers with a constant error of less than one centimeter to the right. (Since readjustment takes place very rapidly in the sight series, and since the four subjects reached out as often and for as long a practice period as they pleased, it only required from one to four sittings to make complete readjustment again.) The subjects were then given the tests with objects at the study table, this time with two changes. First, they reached out at a natural and not a forced rate of movement. Second, the movement of the hand and arm in reaching was carefully screened by a cardboard cover so that the finger was seen only when the reaching movement was concluded. The last precaution was observed to aid in obviating the incentive to correction afforded by the sight of the arm.

The results as given in Table XIII are from too few subjects to justify definite conclusions. While it is worthy of note that none of the errors are significantly larger than in the preceding test, there is still no evidence on the basis of results for these four subjects that the additional precautions taken (of using the

TABLE XIII

SPECIFICITY TEST

At Study Table—with Cardboard Screen—Natural Rate of Movement.

Subject	Per cent Readj. Original	Per Cent Readj. With Practice	Approximate Errors in Cm. to R. of Objects 1	2	3	4
T. L. W.	100	100	7		6	5
K. E. L.	10	100	5	3	3	2
H. L. K.	40	100	7	0	9	6
E. S. R.	53	100	12	14	13	11
Average			7.7	5.61	7.8	6.0

Group	No. Subjects	Average Error in Cm. for Objects 1	2	3	4
With Screen	9	18.0	23.0	10.6	17.4
Without Screen	9	13.0	10.4	2.9	8.9

screen and adopting a natural rate of movement) affected the results.[2]

TABLE XIV

Specificity Test at Study Table, with Cardboard Screen. Natural Rate of Movement. Unpracticed Subjects.

Subject	Error to Right in Cm. 1	2	3	4
G. C.	20	24		15
L. M.	26	25	16	22
G. K.	18	20	13	14
R. W.	17	16	7	13
W. B.	19	24	7	21
H. C.	28	28	16	21
N. G.	26	22	16	16
E. B.	22	25	12	17
R. L.	7	21	9	18
Average	18.1	22.8	10.6	17.4

Comparison of the results of this modified test with practiced subjects with results of the same test given to nine unpracticed subjects does seem, however, to reveal significant differences. Table XIV gives the individual results.

On the face of it these results would indicate that the larger amount of error—over twice as great as for the practiced subjects—must be correlated with lack of practice, and hence that there is evidence of decided transfer of the space habit to the study table situation. Again, however, the experimenter here took special care to instruct the unpracticed subjects not to correct to the left, but to locate the objects as they appeared to be—a care not exercised in the same degree with the practiced subjects. This source of error alone may possibly account for the difference in the results. We may say, however, that this situation does furnish some evidence, though of doubtful value, for transfer.

It is not surprising that if we were unable to get conclusive evidence for transfer to ordinary situations from the test with objects

[2] That the use of the screen does help to obviate the tendency to correct is, however, shown in a comparison of the results of larger groups of *unpracticed* subjects, who were later given short tests at the study table. The results are as follows:

Group	No. Subjects	Average Error in Cm. for Objects: 1	2	3	4
With Screen	9	18.0	23.0	10.6	17.4
Without Screen	9	13.0	10.4	2.9	8.9

at the study table, we were similarly unable to observe any clear differences in the behavior of practiced and unpracticed subjects while walking about the room. Both practiced and unpracticed subjects managed to walk about and perform ordinary acts with no serious mishaps. In general for both there was a constant tendency to walk to the right and to reach out to the right of the actual position of objects. The greater the distance and the quicker the movement the greater were the errors. Errors in reaching were also much greater when the movement of the hand was not seen. There was for most subjects swaying and unsteadiness in walking, as long as visual guidance was employed, and general hesitation and confusion in movement. Some subjects made much greater errors to the right in reaching for objects than others; but among the ten unpracticed subjects thus observed, the errors varied in extent practically as much as with practiced subjects.

We might conclude that these observations indicate that there is no transfer to everyday situations. Two considerations, however, show that this conclusion would not be justified. In the first place, unpracticed subjects in these everyday situations are under the influence of very powerful sensory incentives to immediate readjustment. If the mere visual perception of amount of error, as in Series D, is a strong incentive, how very much stronger will be the perception of the discrepancy in the total sensory situation! In the second place even were an actual transfer effect present in the case of practiced subjects, it might be obscured by the operation of other factors. For instance, subjects who had readjusted to the spatial situation, as far as direction was concerned, might still be unable to judge distance correctly. The writer found that many of her errors were made in estimating depth and distance, not direction. For instance, it was very difficult to walk downstairs with visual guidance, not because of any temptation to go to the right, but because the steps looked curved and much lower than they actually were, and there was consequently an inappropriate muscular reaction.

Much of the uncertainty of the practiced subjects may have been due, then, to this difficulty in adjustment to changed dis-

tance relations. Other disturbing factors are the limiting of the field of vision by the frame of the glasses, and the fact that the stationary prisms in front of the moving eyes produced dizziness and, with a few subjects, even nausea.

But while our observation of the general behavior of the subjects in ordinary situations offers no clear negative evidence on the question of the general nature of the new space habit, neither does it offer positive evidence.

While in general it seems that transfer to ordinary situations is slight, if existent at all, there is evidence that there are individual differences in the matter. Some subjects consistently made large errors both at the study table and in walking about the room, while others made negligible errors, or none.

Subject C. S. of the Auditory Series is one for whom the new habit seemed to carry over effectively into ordinary situations. She had learned to localize the buzzers without error at the apparatus in 25 sittings. At the study table she reached out with perfect ease for the objects, making absolutely no error even on the first trial. (See Table XI). Considering the limitation of the visual field by the glasses, she made her way about the room with ease, making no mistakes in direction.

Subjects M. B. of the Visual Series, with ten sittings, may also possibly have retained the effects of practice in normal situations. Her errors at the study table were all small (the first being only 4 cm.) and soon disappeared. M. B. found it "perfectly easy to get around the room and see objects." She walked about confidently, picking up objects here and there and reaching out for door knobs and the like without any observable sign of a tendency to go to the right. She reported that things looked natural to her, and that when she reached out to touch things they "seemed in the right position." She said she felt no muscular strain or "pull" away from objects, as most other subjects did.

No subjects in the practiced group were able to adapt themselves so well to ordinary situations as M. B. and C. S. It must be remembered, however, that these two are exceptions in the practiced group, and that others in that group constantly made large errors in direction. In the case of subject E. B. of the Visual Series, for instance, the new habit seemed to hold only

for very specific situations. E. B. had made a readjustment of 97 per cent in seven sittings. After taking the trials for visual accuracy without glasses at the end of the series, she found that when she began localizing with glasses again she made just as large an error to the right as at the beginning! It took 30 trials to bring her up again to her newly acquired standard of correct localization. Again when seated at the study table she missed the first object by 20 cm. but the error quickly decreased in the following trials. In walking about the room with the glasses on she again experienced great difficulty, making large errors constantly unless she went very slowly and calculatingly.

The writer, when she had finally attained complete readjustment after 63 sittings, found great difficulty in walking about the room and down the hall. Unless she disregarded the looks of things and trusted to the established kinaesthetic-tactual habits, she made constant errors to the right when distances of several feet were invloved, as for instance, in walking rapidly to a door knob from the middle of the room. In walking down a long hall she bumped into the right wall every few feet unless she used her right arm as guide. But within more definitely prescribed areas her errors were much smaller. In fact as long as she used a natural rate of movement and looked carefully at the objects she was reaching for, she made either very small errors or none at all. Her very large errors at the study table (15 to 28 cm.) were evidently due to the disturbing effect of an unnatural rate of speed, for when she reached out at a natural rate, even with the movement of her arm screened, she localized the objects almost perfectly even on the first trial. In general whenever she moved about the room naturally, without thinking particularly what she was doing, she found herself able to localize correctly almost any object she wished to touch. She found on trial that she was able to serve herself at the table without difficulty, reach for the salt, put sugar into her coffee, etc., without any false movements. It was only when she moved very quickly, or approached objects quickly from some distance, that serious errors to the right were made.

The conclusion is that in M. W's case the new habit probably

functioned to a considerable extent in normal situations as long as the general kinaesthetic setting was the same as prevailed while the new coördination was forming. The very small errors which did appear were easily and unconsciously overcome in the making of practical adjustments. But when large distances were involved the error, being proportionately greater, would inevitably be sufficiently large to interfere with practical accuracy, even though there was a transfer effect. The general confusion, hesitation, and slight dizziness can be accounted for on the basis of other disturbing factors previously mentioned.

None of the unpracticed subjects were able, judging from appearances, to localize objects with the ease and naturalness of M. W., and certainly not with the ease of C. S. and M. B. Moreover the unpracticed subjects were unanimous in reporting a decided "pull" or muscular conflict while some of the practiced subjects, among them the three just named, felt no such muscular strain. For the writer, accurate reaching movements were made with absolutely no feeling of strain or effort.

We may conclude that for some subjects at least there is evidence that the newly acquired habit of judging direction in visual space does function in normal situations. It proved impossible to isolate the various factors involved sufficiently well at the study table to test out accurately the transfer effect there, yet there is some evidence for it even from those tests. More accurate methods are needed and could no doubt be devised.

The consideration of individual cases, however, both at the study table and in more general situations, indicates plainly first that there may be a pronounced carrying over of the habit in the case of some subjects; second that a slight transfer effect probably exists for some subjects but is obscured by other disturbing factors; and third that there are probably marked individual differences in the extent to which the new habit is generalized.

The general conclusion from all the experiments on specificity is that the new space habit is by no means a merely limited and specific mode of functioning, but that it may affect reactions in more general conditions than those prevailing in the original

experiment. The wider significance of this fact is contained in the statement that the systems of retinal and general kinaesthetic habits involved in the new spatial coördination apparently function to a greater or less degree in general situations. This conclusion must be put forward very tentatively, owing to the unsatisfactory nature of the general experimental control.

It is clear, moreover, that the amount of transfer is for most subjects not very marked. In view of the fact that the glasses were worn but a short time, we would not expect the system of habits acquired during that time to have much influence on the old system of retinal-motor habits which has been functioning since infancy. The surprising thing is that there is any interference at all. Considering the conditions of the experiment we have here a remarkably stable and well organized habit system, which functions automatically while the glasses are worn and even carries over to some extent into the established reaction system.

Incidentally it is interesting to note that the new reaction pattern did not disintegrate between trials, but carried over in full strength from one day's sitting to the next, in spite of the conflicting modes of adjustment employed meantime. Thus we have two distinct sets of complex retinal-motor habits, alternating at short or long intervals according to the stimulating situation (whether the glasses are worn or not). This fact is suggestive in connection with the phenomena of alternating personality, in which the same principles operate though on a vastly more complex scale.

VI

RELATION OF READJUSTMENT TO DEFINITE LOCALIZING ACTIVITY

A complete study of the process of the formation of a new spatial coördination would involve an examination of its relation to overt motor activity. Is readjustment conditioned by active efforts to make some definite motor adjustments to the new

situation, or may it occur when the subject takes a merely passive attitude?

It was our original plan systematically to investigate this aspect of the problem. This we could do by giving only one trial per sitting for one group of subjects, and comparing the results with those of groups having, let us say, 20, 40, and 80 trials per sitting. It would be desirable also to devise a method of response by verbal identification instead of active reaching. We did not have time to carry out this plan.

It was thought, however, that some light might be thrown on the problem (especially in so far as it concerns reasons for readjustment in the standard series) by finding out whether or not any readjustment would occur while the subjects merely sat passively without making any overt response at all. It was not practicable to use the apparatus for this purpose, and so with the four subjects used the procedure was as follows:

The subject, wearing the prismatic glasses, was first given a test at the apparatus, to determine his average linear deviation for each of the four buzzers. He reacted by movement of arm and hand as in preceding series. Three trials were taken for each position.

The subject was then seated at a table in another room. After the glasses were put on he remained there passively for 20 minutes, viewing objects in the room, but making no overt localizing movements *of any kind*. Ten such sittings were given. At the close of the tenth, the subject was again seated at the apparatus, and the amount of deviation determined as before.

The results are given in Table XV. A number showing positive increase is preceded by a plus sign and one showing regression by a minus sign. Three of the four subjects show absolutely no decrease in deviation after the ten "passive" sittings. One made an average increase of two cm., but this increase occurred for only two of the buzzers. On the average, there was even a slight regression from the actual position of the buzzers.

There were too few cases, and too small a number of trials in each case, to justify sweeping conclusions. Moreover had the sittings been taken at the regular apparatus, and had they been continued longer, the results would have been more con-

clusive. They do, however, indicate clearly that under these particular conditions no significant readjustment occurs without definite localizing movements. We may say provisionally, then, that apparently the process of readjustment to the new spatial situation is conditioned by definite and overt adaptive movements on the part of the subjects.

TABLE XV

Difference between Initial and Final Localizations

Subject	53	66	79	92	Av.
C. J. W.	+2.0	—5.0	—3.3	+ .5	—1.5
O. W.	+1.6	—2.2	+1.0	— .8	—1.0
A. O. U.	+ .6	.0	+4.6	+3.3	+2.1
J. S.	— .7	—4.9	—1.4	— .9	—1.5

VII

SUMMARY AND CONCLUSIONS

The outcome and signficance of our experiments may be summarized under twelve main heads as follows:

1. No readjustment to the changed visual situation occurred without definite reaching movements of the hand while the eye was fixed on the visual object. Thus the development of the new coördination seems to be conditioned by definite localizing activity on the part of the subject. The process of forming the new habit seems to consist largely in the association of visual and tactual stimuli with kinaesthetic stimuli involved in the localizing movements. This observation is entirely in accord with Stratton's experience. "It was repeatedly noticed in the course of the experiment", he says, "that the total experience was much more harmonious during active movements of my body than when I inactively looked upon the scene." And again "The scene itself became more my own by acting upon it, and this action reacted to bring the representation of my body into harmonious relation to the scene."

2. There was a progressive readjustment in the standard

series, although there were apparently no sensory stimuli indicating the actual position of the object. This seems to represent an unconscious adaptation of the reaching movements to the new kinaesthetic stimuli from the eye muscles. In other words, pare of the readjustment that occurred was not a reorganization of response with respect to the actual position of the object, but represented an adaptation to particular sensory conditions induced by the wearing of the prisms. It is reasonable to suppose that the readjustment in the standard series was due to the tendency of the subject mechanically to react with the hand in response to the old habitual concept of "front" associated with head position, rather than to the new definition of "front" involved in the altered position of the eyes in the head. If so, this would indicate that when there is even a slight disturbance of the customary relationship between ocular-motor habits and general bodily habits, the individual mechanically and unconsciously varies his reactions in such a way as to bring the latter into harmony with the established type of reaction. In any case it seems that slight changes in the delicate muscular mechanism regulating the eye may profoundly influence the overt reactions of an individual although he may be entirely unaware of the effect on his behavior of the new kinaesthetic stimuli.

Experimental verification and further investigation of this hypothesis are needed. While the existence of this hypothetical ocular-motor stimulus to progressive readjustment has presumably interfered with the quantitative accuracy of our measurements of the relative efficacy of various sensory factors, yet its existence as a conditioning factor, if well established, would still be profoundly significant. For it would indicate anew, in a striking way, the extreme intricacy and delicacy of the complex system of retinal and general habits which, developing and functioning automatically, constitutes our spatial experience.

3. Subjects in the auditory series in which the sound offered a sensory clue to the actual position of the subject, showed on the average no stronger tendency to react closer to that actual position than those in the standard series. There may be individual cases in which sound was effective but on the whole the conclusion

is justified that under the conditions of our experiment sound is not an effective factor in the formation of the new spatial coördination.

4. When contact was used as a practical check on the efficacy of the localizing movement, a new habit of localization, objectively correct, was very rapidly built up. Such a new coördination is formed on the basis of mere chance contact, but there was no regular and systematic learning until the subject was allowed each time to check the accuracy of his reaching movement by definite exploratory contact with the buzzer. The combined factors of kinaesthesis and contact then proved to be very important in the formation of the new coördination.

5. Visual perception of the amount of error served as the most powerful single sensory factor in the development of the new habit. The evidence is conclusive that in our experiment vision was at least as efficacious as the combined tactual and kinaesthetic factors involved in active touch; and there is good evidence that it is definitely a more efficacious factor. In this regard our experiments strongly support a tentative hazard of Stratton's for which he was, on the basis of his experiment, unable to adduce direct factual evidence. In discussing the question as to whether or not visual direction is dependent upon tactual direction, he says "If there is any dependence either way (which I doubt) the evidence seems to favor the primacy of sight." In his own experiment there are a number of indications that this is the case. An example is the fact of stubborn persistence of the "old" localization of parts of the body *not visible.* Another is the reference to the old system of the legs in motion while walking, *if not in the visual field at the time.* Evidently the direct visual perception of the amount of error made under the new or disturbed conditions was for Stratton as for our subjects an exceedingly powerful sensory stimulus to new adaptive reactions. The conclusion is strongly suggested that if it had been possible to isolate the contact factor, studying its effect apart from the kinaesthetic stimuli involved in the exploratory movements the "primacy of sight" would have been far more strikingly demonstrated.

6. By far the most rapid acquisition of the new coördination occurred in the tactual-kinaesthetic series, in which the sensory clues to the tactual position of the object (left finger in this case) consisted in a whole system of tactual and kinaesthetic impulses coming from the left arm. We would expect such a wealth of sensory impulses, intimately concerned as they are in so many everyday habitual coördinations, to serve as exceptionally strong stimuli to readjustment for the same reason that we expect the human infant to learn more easily and quickly to localize parts of his own body than external objects. Strange to say, however, of the six subjects in this group only three reacted rapidly to this effective complex of stimuli. The other three were absolutely uninfluenced by the stimuli from their own bodies. One was at the conclusion of the series in absolute ignorance of even the approximate position of his unseen localizing hand! Thus there are evidently striking individual differences in the extent to which the development of a new spatial habit may be conditioned by stimuli from bodily position.

7. The new spatial coördination formed under the conditions of our experiment was retained for long periods of time, functioning at a considerable per cent of its effectiveness even after a lapse of from one to two years. This is in line with experiments on the retention of other bodily habits, and is one among other indications that the learning process involved in the acquisition of the new habit is of a sensory-motor character.

8. The new coördination is not merely specific for the particular conditions of its formation, but maintains itself when the experimental conditions are changed. It even in some cases shows a transitory influence on reactions to ordinary objects after the glasses are removed. This shows that with our type of experiment it is possible to study quantitatively the process of discarding an acquired spatial habit-system. Stratton found that after the removal of his glasses his localization of ordinary objects was interfered with, there being now a tendency to make the opposite type of error, but he was unable of course to gather quantitative data on the extent of the interference.

9. The new space habit seems clearly, for some individuals,

to function in general everyday situations. This conclusion is of practical significance in indicating that this type of experiment may be useful in investigating the question of degree of generalization in the acquisition of spatial habits.

10. There are striking individual differences in the extent to which various sensory factors contribute to the formation of the new spatial coördination, in the time required for its development, and in its strength and stability once acquired. For most subjects tactual and kinaesthetic factors are very efficacious, but for some they have apparently no influence at all. Vision is effective for all our subjects, but in different degrees. Hearing seems possibly to be efficacious for some, but is unquestionably not an influential factor for others. For some the new coördination is easily disturbed, for others not.

Such considerations as these point emphatically to the need for extensive quantitative investigation of the whole subject of the acquisition of spatial reactions. It seems quite likely that much of the disagreement concerning pathological cases as well as normal reactions in the genesis of spatial experience for individuals may be due to a failure to consider the possibility of wide individual differences in the matter.

11. There is no evidence from these experiments that the new coördination was formed on any other than a purely sensory-motor basis. At first it was thought that knowledge of the nature of the error might be a factor making for readjustment, but the control experiments without knowledge disproved this hypothesis. The later experiments abundantly bore out this conclusion. While such factors as interest, conscious shifting of attention, emotional attitude and the like undoubtedly influenced the type and rate of progress of the readjustment or learning at various points, most of it occurred on a purely mechanical or automatic level, while the subject was entirely unaware of the nature of his reactions. Even in the visual and tactual series the subject was aware only of the end results of his reactions, which were in no case, according to the reports of the subjects, under ideational guidance or control.

12. Perhaps the most significant result of this investigation

is the demonstration that it is possible to secure accurate and extensive quantitative data on the problem of the factors in the development of space perception, through the use of relatively simple experimental procedure. We are keenly aware of many defects both in apparatus and in procedure. In the course of the experimenting, however, we have seen ways of obviating these defects which promise much in the way of future investigation of the problem.

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The Influence of Mechanical Guidance Upon Maze Learning

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I

INTRODUCTION

The general purport of this study is an investigation of the influence upon maze learning of the mechanical prevention of error.

The research was carried on in the years 1919-1920 at the Psychological Laboratory of the University of Chicago and was a direct outgrowth of an investigation conducted jointly by Dr. H. A. Carr and the author,[1] in which an attempt was made to train some albino rats to do a task by guiding them for a time through the critical phase of the situation. The guidance was mechanical in its nature, and, while conducting the animal through the proper response, it still permitted him to initiate all of his activities. The problem to be mastered was the alternate choice of the right and left paths of a T-shaped problem box in each day's test of ten successive runs. The results revealed that the group of animals which was guided forty out of every fifty trials did not react to the situation so effectively as did the unguided group. The control was not, however, without marked positive effect upon some of the animals.

The maze problem was selected as the medium for the present investigation for the following reasons: (1) In so far as the maze differs from the problem box just described, its employment will cast some light upon the question of the relation between the nature of the problem and the effectiveness of control. (2) The maze problem is an eliminative type of problem; that is, its mastery involves primarily the elimination of error, rather than the acquisition of any new movement. It is reasonable to expect that control which consists of the prevention of errors will have a greater influence upon the learning of such a problem than upon the learning of those in whose mastery sheer elimination of errors plays a less dominant rôle. (3) The character of the problem is such, furthermore, that it permits a more detailed analysis of the learning process and of the nature of the effect of the control than

[1] "The Influence of Extraneous Controls in the Learning Process," *Psych. Rev.*, vol. 26 (1919), p. 287 ff.

does the problem box hitherto employed. (4) The maze presents a problem which is well adapted to the capacities of both human subjects and rats, and thus makes possible a comparative study of the influence of control upon these widely divergent animal groups.

Our general method of procedure consisted in preventing cul-de-sac errors in certain periods of the learning, by blocking the entrances to the blind alleys. The guiding device was mechanical and, hence, subject to little variation. The subject, moreover, was permitted to initiate all of his movements. In this respect our method of control diverges from that method frequently employed, in which the subject, who is supposedly passive, is guided by the experimenter through the movements of the act to be learned. The influence of this form of control has been investigated by Thorndike,[2] Cole,[3] Yerkes,[4] Hunter[5] and Ludgate.[6]

The problems upon which the present study will attempt to cast light are the following: (1) Does the mechanical prevention of errors during part of the learning process have any influence upon learning? (2) Does the efficacy of the control vary with the period of the learning at which it is administered? A comparison, for instance, of the relative effectiveness of guidance given in the initial four trials, as opposed to control given in the trials from the ninth to the twelfth inclusive, will furnish significant data in regard to this problem. (3) Is the efficacy of guidance a function of the amount given? Our general method of investigating this problem is to consider, for example, the relative effectiveness of two, four or six, etc., directed trials, interpolated in the same general position in the learning process. (4) Does guidance have a similar influence upon human and animal subjects? (5) Does the fact of guidance in the learning period have any influence upon

[2] "Animal Intelligence," *Psych. Rev. Mon. Suppl.*, vol. 2 (1898).

[3] "Concerning the Intelligence of Raccoons," *Jour. of Comp. Neur. and Psych.*, vol. 17 (1907), p. 211 ff.

[4] "The Dancing Mouse," (1907), p. 201 ff.

[5] "A Note on the Behaviour of the White Rat," *Jour. of Animal Behav.*, vol. 2 (1912), p. 137 ff.

[6] "The Effect of Manual Guidance upon Maze Learning," *Psych. Rev. Mon. Suppl.*, vol. 33 (1923).

the retention of the habit? To state the problem more simply: Does a subject who has been guided during the learning of a problem retain the habit as well as the subject who has not been so guided? (6) Does the fact of guidance in the learning period affect the stability of the habit? In other words, is an individual who has mastered the problem with the aid of guidance as likely to be confused when circumstances are slightly altered as is the individual who has learned the problem without extraneous control?

The maze used in the experimentation upon the animals was constructed of oak boards, ½″ in thickness. It was supported by a wooden frame 18″ high and was 4′x3′8″x6″ in size. The pattern of the maze is indicated in Fig. 1. The runways and the cul-de-sacs

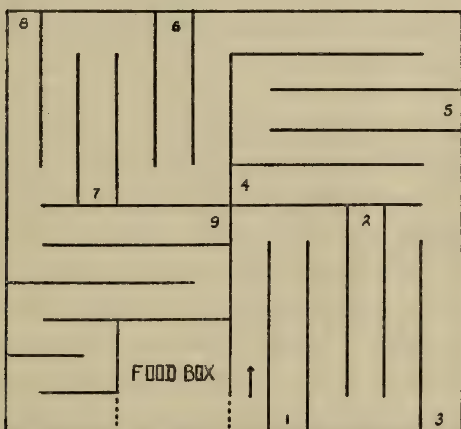

FIG. 1

were 4″ wide. The partitions within the maze, which were made of thin sheets of galvanized iron, were held in place by brass supports. The wood and metal parts of the apparatus were painted dull black. A glass cover permitted observation of all of the maneuverings of the animal while he was in the runways. The doors that opened into and out of the uncovered food-box were sliding doors which, with a little care, could be closed without distracting the animal to any considerable degree.

The blind alleys were closed off, when desired, by pieces of

window glass. Attached to the upper edge of each plate of glass was a blackened brass clamp which, when sunk into the sockets in the walls of the alleys, held the glass partition securely in place. The glass controls were not set in flush with the walls of the main pathway, but rather at a distance of three centimeters from the ends of the cul-de-sacs. This arrangement was adopted in order to avoid, as far as possible, the distraction from the alteration of tactual cues which one would expect to attend the introduction and removal of the controls. Glass, moreover, rather than metal partitions, were employed, in order to reduce to a minimum the visual distraction, which the introduction and abstraction of the control might produce.

After some preliminary experimentation, the results of which indicated that directed trials occurring subsequent to the twelfth have a marked deleterious effect, it was decided to concentrate within the first twelve trials whatever guidance was given the animals.

Series of two, four, six or eight guided trials were, with one exception, inserted in various positions within the first twelve trials involved in the learning of the maze. A series of two successive guided trials was introduced, in the case of one group of animals, upon the first run; in the case of another, upon the sixth run; and for a third group, upon the eleventh run. Four groups of animals were granted a period of control, extending over four successive trials. The period of guidance began with the first, fifth, ninth or thirteenth trial, respectively. Series of six directed trials were employed, in the case of three groups of animals, the introduction of the directed series occurring upon the first, fourth or seventh trial, respectively. Successions of eight guided trials, commencing upon the first, third or fifth run of the learning period, respectively, were likewise employed. One group of animals was given twelve successive directed trials. The normal group, of course, learned the maze without assistance. It is evident from the schema just described that each group of animals received either two, four, six or eight guided runs at either the beginning, middle or end of the first twelve trials. Such a grouping enables one to compare the relative effect of various amounts of guidance, as

well as the effect of the position of the guided trials upon learning.

Sixteen groups of ten animals each were employed in the course of the experiment, each group consisting, because of the scarcity of females, of six males and four females. The rats were from seven to twelve weeks old. Any marked biasing of the results, through differences in the strain of the animals used, was avoided by drawing each group from no less than three different litters.

The rats were carefully tamed and fed in the food-box of the maze for one week before training was begun. Whatever physical mutilation of the animal was necessary for purposes of identification was effected at least three days before training commenced. The position of the maze was never changed during the learning period of any group of animals. Lighting conditions were controlled as far as possible. The shades were drawn and the electric light switched on before work was begun. The experiment was conducted in the late morning and early afternoon hours. The cleaning of the cages and replenishing of the water supply, etc., was cared for after the day's trials. Thus, for the accomplishment of any necessary adjustments to the slight alterations in the environment, a period of twenty-four hours was allowed. The same general position of the living cage of any group of animals was maintained throughout the entire experiment.

The animals were kept normally hungry. They were allowed to feed seven minutes per day on bread and milk, were fed on an average six sunflower seeds per individual per day, and once a week were favored with a small piece of lettuce or apple. One bite of food before each run served to stimulate the proper incentive. The animals of each group were fed together at the end of the daily experimentation.

During the first four days, each rat was granted only one trial per day. Thereafter, however, it was given two trials per day until it succeeded in making four perfect runs out of five successive attempts. This criterion of mastery has previously been successfully employed.[7] No record of the distance traversed was

[7] *Cf.* Webb: "Transfer of Training and Retroaction," *Psych. Rev. Mon. Suppl.*, vol. 24 (1917).

kept, as Miss Hicks[8] suggests; but the method of counting errors obviated to a large degree many of the difficulties she discusses. Any return over a whole or a part of a unit of the true pathway was counted as a return error. A unit of the true pathway, to be explicit, consists of a section of the runway between two successive turns of the true path, irrespective of the length of the section. Every entrance into a cul-de-sac, as well as every retracing toward the end of the cul-de-sac, after the animal had headed toward the entrance, was considered a cul-de-sac error.

Time, measured by a stop watch, was recorded from the moment the rat left the entrance until its whole body, with the exception of its tail, was brought within the food-box.

The maze employed in the experiment upon human subjects was a small stylus maze of the same general design as the maze used for the rats. The cul-de-sacs and the true pathway, which were milled out of a solid aluminum casting, were ¼″ wide and ¼″ deep. The partitions between these wedges were, likewise, ¼″ thick. The outside dimensions of the maze were 5¾″ x 5¼″. Small brass blocks, from the bottom of which projected pegs that could be inserted into small holes drilled into the floor of the maze, were used to block off the blind alleys in the directed trials. The blocks were inserted at the same relative distance from the end of the cul-de-sacs as were the glass controls in the maze used in the experimentation upon animals. The absolute distance was $^3/_{16}$″.

The maze was concealed under a heavy black curtain that covered the top and three sides of a supporting wooden frame. The frame was 1½ ft. wide, 1 ft. deep, and 1 ft. high on the side toward the subject, whereas it was 1½ ft. high on the side exposed to the experimenter. From that side of the frame which was uncovered, the experimenter could observe the progress of the subject. In order to prevent any distracting movement, the maze was held tightly in place by a small wooden frame which was nailed to the table. The black cloth was hung loosely enough on the side toward the subject so that his arms could be easily in-

8 "The Relative Value of the Different Curves of Learning," *Jour. of Animal Behav.*, vol. I, (1911), p. 138 ff.

serted under it. Such an apparatus eliminates the disconcerting effect of blindfolding and reduces the problem largely to a tactual kinaesthetic-motor level.

The subjects were required to trace the maze with a hard rubber stylus, the lower end of which was $^{3}/_{16}''$ in diameter and could be guided easily through the runways. A small rubber shield $^{5}/_{16}''$ from the end of the stylus prevented the fingers of the subject from coming in contact with the maze. For both human and animal subjects the same criterion of mastery was employed.

The subject was seated at a table and the following written directions were given to him: "Please put your right hand under the cover. Grasp the stylus and hold it as erect as possible. Be sure that neither your fingers nor your hand touches the base of the apparatus. Keep the stylus in the groove and explore the assigned area until you are told to stop. Use any method you desire. The aim of the experiment is to find the shortest possible route through the maze." When the subject placed his hand under the cover, the experimenter put the stylus in it and placed the stylus in the groove at the entrance to the maze. Then the experimenter said to the subject, "Now you are in the groove. Explore the maze and I shall tell you when you reach the goal." When the subject reached the goal for the first time, the experimenter said to him, "Now you have reached the goal. The aim of the experiment is to learn to reach this goal without taking any unnecessary steps." The object of giving instructions to the subject thus piecemeal is to avoid confusing him with a large number of directions, the meaning of which can only become apparent when he has had some experience with the situation. The repetition in various forms of the aim of the experiment is necessary in order that each subject may thoroughly comprehend what is desired of him. Such a procedure as Webb's,[9] in which the subject was forced to deduce the aim of the experiment, is wholly undesirable. Webb asserts that because the human subject is blindfolded and is obliged to fathom the desires of the experimenter, his incentive is similar to that of the rat who is placed in the maze and allowed to seek his own deliverance. Upon a close scrutiny of the situation and the behavior of the sub-

[9] *Op. cit.*, p. 14.

jects, the similarity is not so evident. The human subject does, from the first, set for himself a problem. The problem, if the subject is not instructed, differs with each individual. Some subjects believe that the problem is to traverse every inch of the maze, rather than to find the shortest route. The rat, we assume, moves through the maze at first through sheer curiosity and inability to be quiet unless fatigued, ill, asleep or in danger. After the first few trials, food and the maze situation become associated. Each rat, after the initial trials, has the same incentive. But the human subject has no such incentive and no criterion of success unless he is told what he is to do. While Webb's procedure does *a priori* keep the conditions for human and animal subjects strikingly similar, nevertheless, the action of the subjects indicates that the human with a knowledge of the problem has an incentive more nearly comparable to that of the rat than the subject without such information. A comparison of the records for a group of ten subjects who labored through the maze without a knowledge of what was desired of them, with an instructed group reveals that this information is effective in producing a drop in the trial score from 70.6 to 44.3; in the total error score from 476.1 to 325.1; and in the total time score from 2250.82″ to 1465.59″. Such results refute Webb's[10] assertion that knowledge of the aim in the maze problem has little effect on learning.

Because of the great difficulty of inducing a large number of rather disinterested subjects to serve regularly for any length of time, the same distribution of trials was not employed as in the case of the investigation with animals. The experiment was so arranged that the problem could usually be mastered at a single sitting. No subject was detained, however, for more than 1½ hours at a time. If the problem was not mastered within this period, the subject was requested to return every 48 hours until a mastery was effected. If a subject became fatigued, he was dismissed after one hour. Between the first and second trials, as well as between the second and third, a rest of one minute was granted. If the first trial required more than fifteen minutes, the subject was granted all the time he needed to recover from fatigue. After the second

[10] *Op. cit.*, p. 15.

trial a rest of one minute was given between groups of two trials. This distribution of effort in a large measure obviated fatigue, as well as the confusion which results from too steady application.

The subject was at no time informed that he was being guided. The insertion and extraction of the blocks were accomplished noiselessly.

The scheme for the introduction of the controlled trials was slightly varied from the one employed in the experimentation upon the animals, in order to bring out more clearly the effect upon learning of various amounts of guidance. Six groups of subjects were controlled for a period extending over two successive trials. The control, in the case of these groups, was introduced upon the first, third, fifth, seventh, ninth and eleventh trial, respectively. Three groups of subjects were each granted a period of guidance, four trials in length. The series of four controlled runs began, respectively, upon the first, fifth and ninth trial. Two groups were guided through a series of six successive trials, one of the groups being guided through the first six trials of the learning period; the other, from the seventh to twelfth trial, inclusive. Two groups of subjects, likewise, were given eight directed trials; one group being guided from the first to the eighth trial, inclusive; the other, from the ninth to the sixteenth. One group was guided through the initial twelve trials. The normal group learned the maze without assistance.

Each of the fifteen groups consisted of ten individuals—eight women and two men. All were students or instructors at the University of Chicago. Most of the subjects were naïve, so far as the maze situation was concerned. The few students who were familiar with the maze problem were equally distributed through all of the groups, in order to prevent a weighting of the results by this factor.

The retention and distraction tests were carried on 48 hours after the mastery of the problem had been effected. Retention was tested by a single tracing of the maze.

Each subject traced the maze under nine different distracting conditions. The distractions employed were a shifting of the position of the maze through 90°, 180° and 270°, respectively; the

silent recitation of the first stanza of "Mary had a little lamb"; reading aloud; drawing triangles with the left hand while the right traversed the maze, and *vice versa;* tracing the maze with the left hand; and traversing it from the so-called goal back to the entrance. When the maze was shifted 90° from its original position, as well as 180° and 270°, the subject was not informed of the nature of the change, nor was he told that he was being distracted in any way. This procedure of keeping the subject in ignorance of the altered environment until he discovered it for himself, was adopted in order that the conditions might more closely resemble those of general life in which changes in a situation are seldom discreetly labelled, but are rather left to the individual to decipher.

II

THE RELATIVE EFFICACY OF CONTROL INTRODUCED AT VARIOUS POSITIONS IN THE LEARNING PROCESS

It is of great practical value to know what is the most opportune time in the learning process for guiding or instructing an individual and to be cognizant of the effects of guidance at the various stages in the mastery of a problem. Toward the solution of this question the present study has taken only one small step. Our problem is a description and analysis of the relative efficacy of mechanical guidance introduced at various stages in the learning of a maze.

For purposes of analysis it is desirable to consider the influence of control from three points of view: namely, from the point of view of the result immediately manifested, the result subsequently exhibited, and the total result. The immediate influence of the control is that which is evident during the period in which guidance is being administered. The subsequent influence is that manifested in the undirected trials following the controlled series. The total effect is a composite of the two influences just described and will be represented by such measures as total time, total errors and total trials.

Before a discussion of the results is attempted, a comment on the method of deriving the scores is necessary. In order to gain the increased validity resulting from an increase in the number of cases, all available measures which bore on any point in question were employed. There were ten groups of rats, for example, which were unguided in the first two trials. Hence, since there were ten animals in each group, the normal score for these two runs is an average of one hundred measures. The scores for the eleventh and twelfth trials in the normal series, on the other hand, are based upon only twenty measures: *i.e.,* upon the records of the animals in the group which received no guidance and those

in the group guided from the thirteenth to the seventeenth trial. The other eight groups whose records were used in deriving the scores for the first and second trials had received some guidance before the eleventh run. Since a normal score for a given trial is an average of the scores for an unguided run, the total series of trials preceding which are also unguided, the records of these eight groups could not be employed in computing the scores for the eleventh and twelfth trials in the normal series.

The same principles of selection and elimination were utilized in deriving the scores for the directed trials. There were five groups which were guided during the first and second trials. Hence, the scores for the first two directed runs are based upon fifty measures. The scores for the third and fourth trials, when these runs are themselves controlled and preceded by directed trials only, are computed on the basis of forty measures. The record of that group receiving guidance in only two of the initial trials could not be employed in computing the scores for these trials, as it had been in deriving the scores of the first two directed runs. Hence, the reason for the reduction from fifty to forty measures is evident. The number of cases used in deriving any average is indicated in Table 1.

TABLE 1. NUMBER OF CASES USED IN COMPUTING A GIVEN SCORE—ANIMAL SUBJECTS[1]

Serial Number of the Trials for which an Average Score is Sought	Nature of the Trials		Number of Uncontrolled Trials Preceding Trials for which an Average Score is Sought	Number of Controlled Trials Preceding Trials for which an Average Score is Sought	Number of Cases upon which Average is Based
	Controlled	Uncontrolled			
1-2		x			100
3-4		x	2		80
1-4		x			80
5-6		x	4		40
1-6		x			40
7-8		x	6		30
1-8		x			30
9-10		x	8		20
1-10		x			20
11-12		x	10		20
1-12		x			20
1-2	x				50
3-4	x			2	40
1-4	x				40
5-6	x			4	30
1-6	x				30
7-8	x			6	20
1-8	x				20
5-6	x		4		20
7-8	x		4	2	20
5-8	x		4		20
5-8		x	4		30
5-12		x	4		20
3-10		x	2		30
4-9		x	3		30
7-12		x	6		20
9-12		x	8		20

[1] All scores not indicated in the table are based upon 10 cases.

A. Results Based upon the Records of Animal Subjects

1. *The Influence of Two Directed Trials Introduced at Various Positions in the Learning Process*

Let it be recalled that there were three groups of animals which were guided for only two trials. One of these groups was controlled in the first and second trials; another, in the sixth and seventh trials; the third group, in the eleventh and twelfth trials. For convenience, the groups will be designated by the numbers

2 (1-2), 2 (6-7), 2 (11-12), respectively. In the tables and throughout the discussion the first digit in the configuration will be used to indicate the amount of guidance, while the figures in brackets will indicate the trials in which guidance was given.

TABLE 2. INFLUENCE OF TWO DIRECTED TRIALS UPON TRIALS—ANIMAL SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	25.5	8.3	24.67
2 (6-7)	28.8	5.0	14.70
2 (11-12)	31.9	1.9	5.60

Influence upon trials: It is apparent from Table 2 that the control in the three positions acts to reduce the number of trials required for learning the maze; and its efficiency is greatest when it is introduced in the initial trials. This beneficial effect decreases as the series of guided runs is removed farther from the beginning.

It should be noted that the probable errors are not given in the tables. Because of the ambiguity of the meaning of this measure when based upon so few cases, its omission was deemed advisable. The reliability of the results may be judged by the consistency of the general tendencies exhibited.

The symbol of negativity employed in some of the subsequent tables also requires explanation. It is used when the score of the guided group is greater than that of the normal group. A negative saving, then, of an absolute or relative sort, means that the score of the controlled group exceeds absolutely or relatively that of the uncontrolled group by the amount indicated.

TABLE 3. INFLUENCE OF TWO DIRECTED TRIALS UPON TOTAL ERRORS—ANIMAL SUBJECTS

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	143.22	16.93	10.57
2 (6-7)	120.16	39.99	24.97
2 (11-12)	145.70	14.45	9.02

Influence upon errors (Table 3): Guidance reduces the total number of errors made in the entire learning process. Group 2 (6-7) is the most benefited; groups 2 (1-2) and 2 (11-12) exhibit about the same amount of saving.

By a detailed examination of the error scores we may ascertain some of the factors and mechanisms which combined to produce the totals just described. The immediate effect of control in its most obvious form is the prevention of cul-de-sac errors. The number of cul-de-sac errors prevented during the control period is a function of the length of the directed series, as well as its position. In the later trials when, through the very nature of the learning process, fewer errors are being made than early in the learning, the influence of the guiding device as a means of preventing errors must necessarily decrease. For the same reason, as the series in any given position increases in length, the saving in cul-de-sac errors per trial decreases. But in this sheer physical prevention of cul-de-sac errors we have little interest. The truly significant immediate effect of the control will be revealed in the return error scores.

TABLE 4. IMMEDIATE INFLUENCE OF TWO DIRECTED TRIALS UPON ERRORS—ANIMAL SUBJECTS

A.

Group	Av. No. of Cul-de-sac Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	0	6.06	
2 (6-7)	0	3.89	
2 (11-12)	0	3.05	

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	22.11	—1.00	—4.74
2 (6-7)	.55	2.41	81.42
2 (11-12)	1.95	—.92	—89.32

Table 4 indicates that the control has little, perhaps even a slightly deleterious, immediate effect, upon the return errors when it is introduced in the initial position. This unfavorable influence on return errors in the initial trials is, doubtless, a result of the fact that in the early stages of the learning, entrances into cul-de-sacs do operate to prevent complete returns to the beginning of the maze. When the cul-de-sacs are blocked, the animal which has once headed back toward the starting point has little to prevent a complete retracing of the pathway. Hence, when returns are the only possible errors, more of them are made than when cul-de-sacs may also waylay the victim.

Entrances into cul-de-sacs in the intermediate trials, on the other hand, instead of operating to prevent complete retracings, as they do in the initial trials, tend to increase the opportunity for retracing, for the return path in the first few sections of the maze, at least, has by the sixth trial, as a rule, been well mastered. Hence, when cul-de-sacs are blocked, the animal that is still in a somewhat exploratory stage of the learning and not greatly dependent on fixed cues, is guided easily forward to the goal. The difficulties and confusion caused by the cul-de-sacs is lacking. Confusion resulting from the novelty of the situation has worn off. This com-

plex of conditions is probably the explanation of the large absolute, as well as relative, saving in return errors in the sixth and seventh trials.

In the case of that group of animals for whom the guided series was most distantly removed from the beginning, however, a marked increase in return errors is exhibited during the period of control. The animal, presumably, by the eleventh trial has become greatly dependent on certain cues. Blocking the entrances to the cul-de-sacs modifies some of the cues, causes confusion, and, since return errors are the only ones possible, more of them are made than normally.

In our tabular analysis of the subsequent effect of control we shall consider only the average number of cul-de-sacs and the average number of return errors amassed per trial in the post-control period. For a more minute analysis of the subsequent influence of guidance, *i.e.,* the determination of the period of greatest influence, the persistence of the effect, the conflict of the distracting and beneficial forces, we may rely for our data on the learning curves.

TABLE 5. SUBSEQUENT EFFECT OF TWO DIRECTED TRIALS UPON ERRORS—ANIMAL SUBJECTS

A.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	2.12	—.14	—7.07
2 (6-7)	.93	.84	47.46
2 (11-12)	.92	.37	28.68

B.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	2.00	—.88	—85.98
2 (6-7)	.89	—.08	—9.87
2 (11-12)	.65	—.14	—27.45

Group 2 (1-2) manifests an increase above the normal in the average number of cul-de-sac errors amassed per trial for the period subsequent to the guided interval; groups 2 (6-7) and 2 (11-12) exhibit, on the other hand, a positive saving (see Table 5). Each of the groups, however, was unfavorably influenced, so far as the average number of return errors accumulated per trial in the post-control period is concerned, the relative loss being greatest for group 2 (1-2), least for group 2 (6-7). It is significant that the deleterious influence of the control is confined largely to the realm of the return errors and that in each group the return errors fare worse than the cul-de-sacs. Benefit, then, when it occurs, is in terms of a saving in those errors which, during the period of the control, had been prevented by physical force.

In order to make a more complete analysis of the influence of control upon errors, we have superimposed the curves of the directed groups upon that of the normal group. The discussion which follows is based upon a consideration of the relations between the scores of the normal and guided groups revealed by this device. Immediately following the period of control the curve of group 2 (1-2)[2] exhibits the large steeples which raise it alternately above and below the normal. After four trials characterized by this wavering, the curve of the directed group follows the normal fairly closely, but tends, on the whole, to fall slightly more rapidly and irregularly. The steeples following the period of control indicate confusion. It is significant that this wavering is short-lived. Reactions developed in the first two trials have little opportunity to become fixed, and, hence, the period of their effect is limited.

The curve for the group guided on the sixth and seventh trials (Figure 2) shows somewhat different characteristics. It remains below the normal curve following the period of direction, although exhibiting many steeples and a tendency to a slight rise in the eight trials subsequent to the control. After the period of the steeples, the curve follows that of the normal group with little significant

[2] Only a few typical curves are given. The reader may know that a curve has been omitted unless it is referred to by number in the text.

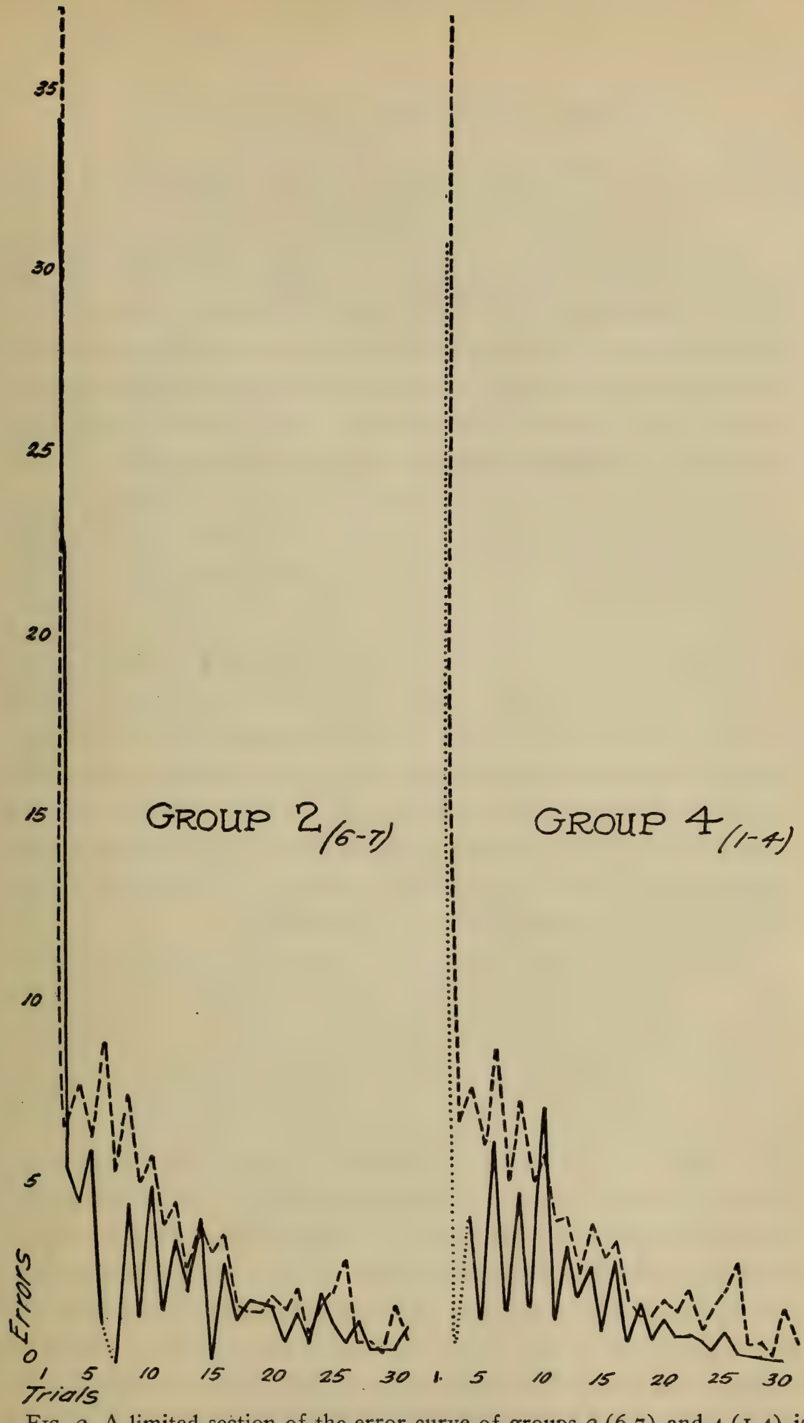

FIG. 2. A limited section of the error curve of groups 2 (6-7) and 4 (1-4) is shown superimposed upon the error curve of the unguided group. The dashes denote the unguided group; the dots, the guided trials of the guided groups; the solid line, the unguided trials of the guided groups.

deviation. The long period of wavering (extending over eight trials) is to be expected because the reactions to the maze situation formed in the trials previous to the period of guidance have become fairly clearly defined, though not rigidly fixed. The steeples may be interpreted, then, to represent the conflict between the somewhat flexible reactions established in the runs preceding the directed trials and the likewise unstable habits formed during the short period of control. The reactions most recently made seem, in general, to triumph over those most frequently made. Hence, the curve of the guided group remains below the normal.

The introduction of guidance in the eleventh and twelfth trials has apparently little subsequent effect upon the errors, for the curve of the guided group jumps back to the normal after the period of control and follows the normal fairly closely thereafter. Pronounced steeples are not present. The situation in the case of group 2 (11-12) probably differs from that of group 2 (6-7) in that the reactions to the maze have become well fixed by the eleventh trial. Alteration of the cues during the eleventh and twelfth runs causes confusion; but the change in the situation does not continue long enough to uproot habits previously well established. Consequently, when the control is removed, the animal readily slips back to his former modes of responding.

The important facts revealed by the error scores are as follows: (1) The influence of the control is selective. When errors are reduced in the runs subsequent to the guided trials they are largely those which were prevented during the period of guidance; namely, the cul-de-sac errors. Return errors tend to be slightly increased after the period of guidance. (2) Control causes, as well as prevents, errors. The total result is a balance of the two tendencies. (3) Control reduces the total number of errors made during the whole learning process. (4) Interpolation of direction in the intermediate position results, when any or all of the error scores are used as measures, in the greatest relative gain or the least relative harm. (5) Although the number of errors made per trial during the period subsequent to control may be increased, the mastery of the maze may still be attained more readily than when no guidance is administered.

TABLE 6. INFLUENCE OF TWO DIRECTED TRIALS UPON TIME—ANIMAL SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	1389.86	360.86	20.61
2 (6-7)	1587.95	162.77	9.30
2 (11-12)	1754.43	—3.71	—0.21

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	367.82	142.69	27.95
2 (6-7)	25.07	23.02	47.87
2 (11-12)	34.63	—8.31	—31.57

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	33.56	—11.72	—53.66
2 (6-7)	20.78	—.11	—.53
2 (11-12)	21.24	—3.21	—17.80

Influence upon time (Table 6) : The influence of control upon the total time required to master the maze is, in general, beneficial. The time of group 2 (11-12), however, differs little from the normal. The efficacy of the guidance as a time-saving device varies inversely as the distance of the directed series from the initial trial.[3]

The immediate influence of guidance upon time is beneficial, if the period of control is not too far removed from the initial trials. In group 2 (11-12), however, an increase in time is exhibited. Group 2 (6-7) manifests a greater relative gain than group 2 (1-2).

Of the two groups, 2 (1-2) and 2 (11-12), showing a large increase in time per trial in the runs following the period of guid-

[3] The time scores throughout the monograph are stated in seconds.

ance, group 2 (1-2) sustains the greatest relative loss. This deleterious subsequent effect of control, besides being a result of distraction, may be a function of the insufficient opportunity to gain great facility in running the true pathway of the maze, which results from the decrease in the number of trials. That this latter factor is not alone operative, however, is evident from the fact that the relative loss in the three groups does not vary consistently with the number of trials saved.

Conclusion: The influence of control upon total time, errors and trials is beneficial. The degree of benefit in trials and total time is inversely proportional to the distance of the directed series from the initial trials. The intermediate position of the guided series seems most favorable to the reduction of errors. The immediate effect of control in the initial position and in the position most distantly removed from the early trials is to increase the number of return errors. The subsequent effect of guidance upon time and return errors is deleterious.

2. *Influence of Four Directed Trials Introduced at Various Positions in the Learning Process*

Let it be recalled that four groups of animals were guided for a series of four successive trials. Control was administered from the first to the fourth, from the fifth to the eighth, from the ninth to the twelfth, and from the thirteenth to the sixteenth trials in the various groups.

TABLE 7. INFLUENCE OF FOUR DIRECTED TRIALS UPON TRIALS—ANIMAL SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
4 (1-4)	22.0	11.8	34.9
4 (5-8)	28.1	5.7	16.9
4 (9-12)	29.1	4.7	13.9
4 (13-16)	28.8	5.0	14.8

Influence upon trials (Table 7) : The positive influence of these four-trial series upon the total number of trials necessary to master

the problem manifests, in general, as in the two-trial series, a decreasing magnitude the farther the position of the series is from the initial trial. The most marked increase in the number of trials —perhaps the only significant increase—resulting from position differences in the controlled series appears between groups 4 (1-4) and 4 (5-8). There is little difference in the amount of saving in groups 4 (5-8), 4 (9-12) and 4 (13-16).

TABLE 8. INFLUENCE OF FOUR DIRECTED TRIALS UPON TOTAL ERRORS—ANIMAL SUBJECTS

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
4 (1-4)	99.90	60.25	37.62
4 (5-8)	107.71	52.44	32.74
4 (9-12)	133.03	27.12	16.93
4 (13-16)	144.65	15.50	9.68

Influence upon errors: As in the case of trials, the control, while always resulting in a saving, decreases in efficiency the more distant is its point of introduction from the beginning of the learning. The total error score (see Table 8) shows a regular increase from groups 4 (1-4) to 4 (13-16).

The immediate effect, as we have previously indicated, is a function of the sheer physical prevention of cul-de-sac errors and a less tangible influence upon return errors. It is obvious that the number of cul-de-sac errors which the control has opportunity to prevent, decreases in accordance with the nature of the learning process by which the maze is mastered, as the series of directed trials is removed farther from the beginning. A discussion of the influence of this physical factor we shall omit in the subsequent presentation of results.

The return errors amassed per trial during the period of control (see Table 9) are considerably greater in number in three of the groups than those made in the corresponding trials of the normal group. The increase above the normal of the return errors in the initial trials we have accounted for on the basis of a tendency to complete retracings when cul-de-sacs are not present.

TABLE 9. IMMEDIATE EFFECT OF FOUR DIRECTED TRIALS UPON ERRORS—ANIMAL SUBJECTS

A.

Group	Av. No. of Cul-de-sac Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
4 (1-4)	0	4.90	
4 (5-8)	0	3.81	
4 (9-12)	0	3.47	
4 (13-16)	0	2.45	

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
4 (1-4)	14.54	—1.57	—12.10
4 (5-8)	2.89	.11	3.67
4 (9-12)	2.23	—1.12	—100.90
4 (13-16)	1.37	—.47	—52.22

The negative saving in the latter trials, it is reasonable to believe, results from the conflict of habits arising from the alteration in the sensory cues. The balance of factors probably contributing to the slight positive saving in the return errors amassed in the directed trials which are inserted in an intermediate position, we have described in the discussion upon the influence of two controlled trials.

The subsequent effect of guidance (see Table 10), so far as cul-de-sac errors are concerned, is beneficial. The relative positive effect upon cul-de-sac errors amassed per trial increases the more distantly removed (within certain limits) the guided series is from the initial trials. This effect reaches its maximum in the last few of the first twelve trials and decreases thereafter. Guidance late in the learning can do little but interfere with a well-nigh perfected reaction to the maze situation.

It is significant, moreover, that in each of the groups the saving in the realm of cul-de-sac errors in the post-control trials is greater than in the realm of return errors. In other words, those errors which were previously prevented are those which are relatively most reduced after guidance ceases.

TABLE 10. SUBSEQUENT EFFECT OF FOUR DIRECTED TRIALS UPON ERRORS—ANIMAL SUBJECTS

A.

Group	Av. No. of Cul-de-sac Errors per Trial for the Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
4 (1-4)	1.46	.85	36.79
4 (5-8)	1.01	.60	37.27
4 (9-12)	.75	.54	41.86
4 (13-16)	.70	.19	21.35

B.

Group	Av. No. of Return Errors per Trial for the Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
4 (1-4)	1.03	—.29	—39.18
4 (5-8)	.57	.16	21.92
4 (9-12)	.45	.06	11.76
4 (13-16)	.77	—.38	—97.44

The return errors made per trial are increased above the normal in the post-control period when the guidance is administered in the initial trials or late in the learning process. The negative saving in group 4 (1-4) is probably the result, to a large extent, of the retracing habit set up in the initial trials and accentuated by confusion resulting from changed sensory cues upon the removal of the controlling device. In group 4 (13-16), however, we have reason to believe that this apparently great increase in return errors is a function of the distracting effects of the control, for group 4 (9-12), which exhibits a greater relative loss during the period of direction, nevertheless, manifests a gain in the post-control period. The length of the guided series, we may argue, was not sufficient to permit an adjustment to the cues substituted for those fixed through twelve trials of practice. The conflict, then, of the partially completed readjustment habits with the old habits may have been the cause of the increase in errors. Confusion need not have been very pronounced, however, to have given rise to the

apparently enormous relative increase in return errors, since a single return error in these later trials has great weight.

The error curves of the four groups may be compared on the basis of regularity and speed of decline, as well as position above and below the normal. Each one of the curves, following the control period, begins below the normal. The post-control period is characterized by steeples which lie either on a rising or level curve, thus indicating a time of great uncertainty on the part of the rats. These steeples persist for six trials in the case of the groups 4 (5-8), 4 (9-12) and 4 (13-16), and for ten trials in the case of the group guided in the initial runs (Figure 2). The steeples are not sufficiently high, except in the case of group 4 (13-16), to cause the curve of the controlled group to cross the normal for more than one trial. It is significant that, while the group guided in the initial trials shows the greatest disturbance, a readjustment is readily effected and the curve sinks rapidly, whereas, when control is introduced later in the learning process, a rapid fall is not apparent.

Influence upon time (Table 11): In all but one group, guidance reduces the total time required to perfect the reaction to the maze situation. The factors influential in producing these totals will be revealed, in part, by an inspection of the time scores for the control and post-control periods, as well as the scores in trials.

The immediate effect of guidance introduced early in the learning, when habits are in a fluid state, is a reduction in the time. If control is introduced later, when habits have crystallized, a marked loss is evidenced. This same detrimental influence of control interpolated at a position too remote from the initial trials was manifested in the error scores. Time and error are, of course, dependent variables. Whether or not time increases independently of errors matters little, for an increase in one or both may easily be accounted for in terms of the confusion resulting from the alteration of sensory cues which had been well integrated into the habitual reactions.

With the exception of group 4 (5-8) all groups manifest in the post-control period a considerable increase above the normal in the average time consumed per trial. This increase, however, in

TABLE 11. INFLUENCE OF FOUR DIRECTED TRIALS UPON TIME—ANIMAL SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
4 (1-4)	1298.97	451.75	25.80
4 (5-8)	1547.30	203.42	11.61
4 (9-12)	1841.39	—90.67	—51.79
4 (13-16)	1722.91	27.81	15.89

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
4 (1-4)	234.87	76.59	24.59
4 (5-8)	33.96	13.87	29.00
4 (9-12)	46.28	—19.94	—75.70
4 (13-16)	31.66	—11.63	—58.06

C.

Group	Av. Time per Trial for the Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
4 (1-4)	30.99	—9.62	—45.01
4 (5-8)	18.45	.30	1.60
4 (9-12)	25.37	—7.34	—40.71
4 (13-16)	19.59	—2.48	—14.49

time per trial is not entirely unambiguous as an index of the nature of the influence of the control. All of the groups exhibit a saving in trials. Although a reduction in time is a function of the accuracy of the reaction to the maze, the number of errors made, it is also a function of the speed of running which is attained as a result of practice, as well as confidence gained with experience. The slight saving in group 4 (5-8) is significant because it occurs in spite of a reduction in trials. The fact, furthermore, that the increase in time is not directly proportional to the reduction in errors indicates that control does have an influence upon time which is independent of trials.

The time curves for the groups guided for four trials reveal little that has not been indicated in the tables, except that in the final stages of the learning the time scores lie below the normal; *i.e.,* the ultimate effect of control upon time is beneficial. Steeples indicating uncertainty are unequivocally present in the case of the curves for groups 4 (1-4), 4 (9-12) and 4 (13-16). The steeples, as well as the subsequent descent of the curve, are greater for group 4 (1-4) than for group 4 (9-12) or 4 (13-16). This indicates greater confusion, but more rapid readjustment when control is introduced in the initial trials.

Conclusion: In general, the saving in total trials, time and errors is positive and varies inversely as the distance of the directed series from the early trials. The initial position is decidedly most favorable to the reduction of trials. The saving in errors, considered independent of trials, is largely in the realm of cul-de-sac errors. The effect of control upon return errors is, in general, detrimental. Especially is this true when guidance is interpolated in the initial trials or in positions well removed from the beginning.

3. *Influence of Six Directed Trials Introduced at Various Positions in the Learning Process*

The series of six successive directed trials were introduced upon the first, fourth and seventh run.

TABLE 12. INFLUENCE OF SIX DIRECTED TRIALS UPON TRIALS—ANIMAL SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
6 (1-6)	15.5	18.3	54.14
6 (4-9)	18.3	15.5	45.86
6 (7-12)	29.7	4.1	12.13

Influence upon trials (Table 12): As are lesser amounts of guidance, so the series of six directed trials are effective in reducing the total number of runs required to master the problem. The effectiveness of the control, as an agent for decreasing the total

trials, diminishes as its point of interpolation is removed more distantly from the initial runs.

TABLE 13. INFLUENCE OF SIX DIRECTED TRIALS UPON ERRORS—ANIMAL SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
6 (1-6)	69.73	90.42	56.46
6 (4-9)	73.55	86.60	54.07
6 (7-12)	116.16	43.99	27.47

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
6 (1-6)	10.87	—2.05	—23.24
6 (4-9)	.37	1.96	84.12
6 (7-12)	1.38	.32	18.82

C.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
6 (1-6)	.43	1.32	75.43
6 (4-9)	.54	.95	63.76
6 (7-12)	.70	.59	45.73

D.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
6 (1-6)	.60	.28	31.82
6 (4-9)	.51	.14	21.54
6 (7-12)	.45	.06	11.76

Influence upon errors (Table 13): A similar tendency for the effectiveness of the control to decrease, the later it is given in the

learning process, is evident in the total error scores. The initial and intermediate positions, however, differ relatively little in effectiveness.

The immediate result of the control, measured in terms of return errors, manifests, likewise, the same tendencies that we have noted in our consideration of the influence of various other amounts of guidance. The number of return errors accumulated during the directed series in the initial position is greater than that amassed by the normal group. The usual negative saving in the directed trials interpolated in the final position is not present, though in comparison with group 6 (4-9), a decided decrease in relative saving is shown. Since the point of the introduction of the control, as the series grows longer, occurs earlier in the learning process—when habits have not become well fixed—it is reasonable to expect that the most distracting effect would not be so prominent, and hence, a saving in return errors more probable, than in the case of the shorter series.

The subsequent influence of the control upon the errors, both return and cul-de-sac, made per trial is beneficial; but the relative saving decreases the farther the position of the directed series is from the initial trial. Again, it is worthy of note that the saving in cul-de-sac errors is much greater in each group than the relative saving in return errors.

The error curves reveal little that is new. The curve for group 6 (1-6) begins, subsequent to the period of direction, below the normal curve. It exhibits only one steeple and then falls rapidly and regularly to the base line. In no place does it rise above the normal curve. The curve for group 6 (4-9) (Figure 3) rises in the trials immediately succeeding the period of guidance, but crosses the normal curve only once. It has three pronounced steeples before beginning its decline, which, when once started, is rapid and fairly regular. The curve for group 6 (7-12), on the other hand, does not manifest very marked steeples. While it does start below the normal in the post-control period it quickly rises to meet the normal and follows the latter closely. The persistence of the effect of the guided series, when it is introduced late in the learning process, as well as the magnitude of the effect, is slight.

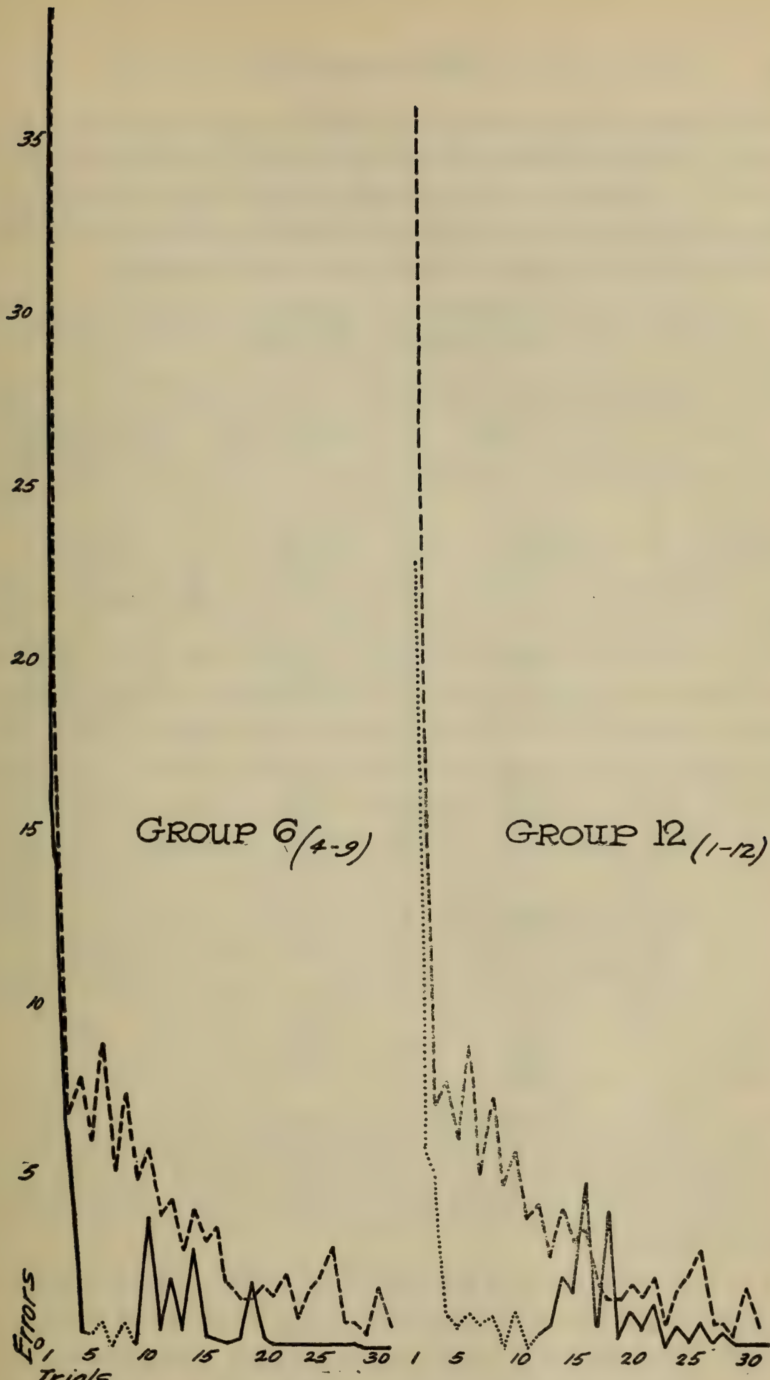

FIG. 3. A limited section of the error curve of groups 6 (4-9) and 12 (1-12) is shown superimposed upon the error curve of the unguided group. The dashes denote the unguided group; the dots, the guided trials of the guided groups; the solid line, the unguided trials of the guided groups.

The curves, then, reveal that (1) the most persistent effect is apparent when the earlier trials are guided; (2) the wavering produced by the abstraction of the control is greatest in the intermediate period; and (3) that the least effect is exhibited under the condition in which control occurs late in the learning.

TABLE 14. INFLUENCE OF SIX DIRECTED TRIALS UPON TIME—ANIMAL SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
6 (1-6)	1079.61	671.11	38.33
6 (4-9)	1238.94	511.78	29.23
6 (7-12)	1628.95	121.77	6.96

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
6 (1-6)	174.59	2.10	1.19
6 (4-9)	20.58	14.41	41.19
6 (7-12)	25.77	4.18	13.95

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
6 (1-6)	18.24	1.78	8.89
6 (4-9)	14.15	4.95	25.92
6 (7-12)	18.26	—.23	—1.28

Effect upon time (Table 14): The total time necessary for mastering the problem varies directly with the distance from the initial trial at which guidance is given. Control in all cases, however, reduces the time.

The immediate effect of the control upon time presents a slightly different picture. When guidance occurs in the initial position, its apparent influence is almost negligible; but when it occurs in the intermediate and final positions, a large relative saving is ex-

hibited. The marked reduction in time per trial for those trials in the intermediate position is probably mediated largely by the reduction in errors which we have already described.

Of the balance of factors tending to increase the time per run in the post-control period and those tending to facilitate the running, the latter are dominant in groups 6 (1-6) and 6 (4-9), but most influential in the case of group 6 (4-9). The slight increase in time per trial for the trials following the directed series in group 6(7-12) is significant, since it is the only hint we have of the usual confusion attendant upon the late introduction of the control. The distracting phase of the control's influence was not manifested in the error scores as it usually is.

The time curves add little to the information furnished by the tables, except in regard to the persistence of the influence of the control. The time curve for group 6 (1-6) starts, in the period subsequent to the control, below the normal and, like the error curve for the same group, has one marked steeple before its regular descent begins. The curve for group 6 (4-9) remains always below the normal; but a series of small steeples indicate that confusion was operative over a longer period than in the previous group. The curve for group 6 (7-12), on the other hand, crosses and lies above the normal curve for some time. Its descent is slow, but slightly more regular than that of the normal curve.

Conclusion: The efficacy of the control, measured in terms of total trials, total errors and total time, varies inversely with the distance of the guided series from the initial run. Guidance given in the intermediate position is favorable in its immediate effect upon both time and errors; and the relative degree of its influence is greater than that of control occurring earlier or later. The subsequent effect of the control upon errors is favorable. It is greater in the realm of the cul-de-sac than return errors, and varies for both types inversely as the distance of the directed trials from the beginning of the learning process.

4. *Influence of Eight Directed Trials Introduced at Various Positions in the Learning Process*

Three positions of a series of eight successive trials were employed. The guided series began upon the first trial, the third trial and the fifth trial.

TABLE 15. INFLUENCE OF EIGHT DIRECTED TRIALS UPON TRIALS—ANIMAL SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
8 (1-8)	19.9	13.9	41.12
8 (3-10)	30.6	3.2	9.46
8 (5-12)	26.8	7.0	20.71

Influence upon trials (Table 15): All groups exhibit a positive saving in trials; but in this series we meet the first exception to the rule that the efficacy of the control, as measured in terms of the number of trials required for learning the problem, varies inversely as the distance of the directed series from the initial trials. Group 8 (5-12) exhibits a greater saving in trials than does group 8 (3-10). For this no explanation is apparent except that of the chance assembling in one group of several animals which behaved eccentrically. One animal, for instance, after he had practically mastered the problem, consumed twenty-six trials in the elimination of one error.

Influence upon errors (Table 16): Guidance effects a marked positive saving in the total number of errors made by each of the three groups. The initial position seems most efficient for error reduction. The intermediate and final positions of the control seem about equally effective.

The immediate influence of guidance administered for eight trials shows some tendencies not hitherto displayed. The positive saving in return errors made during the period of control which includes the initial trials is contrary to our usual findings. That it is no chance result is supported by the fact that the average number of return errors made in the first twelve trials by the

TABLE 16. INFLUENCE OF EIGHT DIRECTED TRIALS UPON ERRORS—ANIMAL SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
8 (1-8)	71.53	88.62	55.34
8 (3-10)	108.63	51.52	32.17
8 (5-12)	107.71	52.44	32.74

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
8 (1-8)	5.84	1.08	15.67
8 (3-10)	1.61	.59	26.82
8 (5-12)	2.43	—.23	—10.45

C.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
8 (1-8)	.45	1.16	72.05
8 (3-10)	.93	.46	33.09
8 (5-12)	.70	.59	45.73

D.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
8 (1-8)	.30	.43	58.90
8 (3-10)	.95	—.35	—58.33
8 (5-12)	.50	.01	1.99

group guided during these runs also exhibits a saving (of 29%) over the normal. The hypothesis previously advanced that cul-de-sacs do prevent complete retracings and hence their absence increases the return error score applies, then, only to the first six trials. The groups guided for more than six of the initial trials

have practically mastered the true pathway of the maze. The retracing habit is readily eliminated in a cul-de-sac-less maze, as soon as the association between food and the maze situation has been well established.

The negative saving in the number of return errors made during the period of control by the group whose guided trials were most distantly removed from the initial run is in accord with a tendency which we have previously noted and accounted for on the basis of confusion resulting from the altered sensory cues.

The large positive saving in return errors in group 8 (3-10) is, probably, due to the fact that guidance was introduced sufficiently early to avoid conflict with any fixed maze habits and to prevent the formation of any elaborate retracing habits resulting from the absence of cul-de-sacs.

In all of the records used to analyze the effect of control upon the behavior in the post-control period, the three groups we are discussing maintain the same relative rank. Group 8 (1-8) ranks first; group 8 (5-12), second; and group 8 (3-10), third. The saving in cul-de-sac errors is greater than in the realm of return errors in each of the groups. It is significant, also, that initial guidance, as in the case of the six-trial series, is the most beneficial in its subsequent influence. Probably two alterations of sensory cues (the introduction and removal of the control), if the guided series is sufficiently long to permit the development of a genuine dependence upon the cues, are more disturbing than one alteration; namely the mere removal of the control.

The rather high cul-de-sac error score of group 8 (3-10) for the post-control period is somewhat difficult to account for, except in terms of chance. The fact that the group which did excel during the period of guidance suffers this increase in return errors in the trials following the period of guidance, gives plausibility to the explanation couched in terms of chance. It is possible, of course, that change of cues upon the eleventh trial is particularly disrupting. This assumption of the unique nature of the eleventh trial seems, however, fanciful to the writer.

The curves of all the groups show a marked wavering in the post-control period. The curve of group 8 (1-8), which through-

out all its course remains below the normal, exhibits small steeples for eleven trials immediately after guidance, then drops suddenly and regularly to the base line. The curve for group 8 (3-10) starts below the normal curve in the post-control period; but its steeples, which persist for about eleven trials, rise alternately above and below the normal. Subsequent to this period of rather conspicuous wavering, the curve follows the general course of the normal curve. The curve for group 8 (5-12) exhibits a period of wavering covering seven trials, in which the steeples rise alternately above and below the normal. In the latter part of its course the curve sinks below the normal and remains consistently slightly below. While the period of wavering has about the same extent in all of the groups, the readjustment, as we have frequently indi-

TABLE 17. INFLUENCE OF EIGHT DIRECTED TRIALS UPON TIME—ANIMAL SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
8 (1-8)	1076.73	673.99	38.50
8 (3-10)	1537.65	213.07	12.17
8 (5-12)	1476.37	274.35	15.67

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
8 (1-8)	88.60	16.57	15.76
8 (3-10)	27.67	10.16	26.86
8 (5-12)	25.85	6.46	19.99

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
8 (1-8)	13.72	5.03	26.83
8 (3-10)	19.20	—.25	—1.32
8 (5-12)	14.32	3.71	20.58

cated, is more rapid and regular when guidance is administered in the initial trials.

Influence upon time (Table 17): The records and curves reveal few tendencies which could not have been predicted from the error records and accounted for on the basis of the same factors operative in making the error records as they are. A detailed discussion of the results would accomplish little.

Conclusion: Eight directed trials introduced in the initial position are most effective in reducing trials, errors and time; eight controlled trials in the intermediate position are least effective, though still beneficial.

B. Results Based upon the Records of Human Subjects

Our general method of deriving scores we have already discussed at the beginning of the chapter. Table 18 merely furnishes the data with respect to the number of cases used in computing the scores based upon the records of the human subjects.

1. *Influence of Two Directed Trials Introduced at Various Positions in the Learning Process*

In the experiment conducted upon human subjects, six groups were guided for two successive trials. The introduction of the directed series occurred in the various groups upon the first, third, fifth, seventh, ninth and eleventh trial, respectively. The groups so guided will be referred to as H2 (1-2), H2 (3-4), H2 (5-6), H2 (7-8), H2 (9-10) and H2 (11-12).

Influence upon trials (Table 19): With one exception, two directed trials, whatever their position, have a beneficial effect, when this effect is measured in terms of the number of trials required to master the problem. Guidance in the initial trials acts to reduce the number of runs. Control in the third and fourth trials, on the other hand, effects a marked increase above the normal in the number of runs required; but after the fourth trial, guidance again results in a saving which increases as the series is interpolated farther and farther from the beginning. There is, however, an optimum position (ninth and tenth trials) beyond which the efficacy of the control appears to decrease. This is at variance

TABLE 18. NUMBER OF CASES USED IN COMPUTING A GIVEN SCORE—HUMAN SUBJECTS[4]

Serial Number of the Trials for which an Average is Sought	Nature of the Trials		No. of Uncontrolled Trials Preceding Trials for which an Average Score is Sought	No. of Controlled Trials Preceding Trials for which an Average Score is Sought	No. of Cases upon which Average is Based
	Controlled	Uncontrolled			
1-2		x			100
3-4		x	2		90
1-4		x			90
5-6		x	4		70
1-6		x			70
7-8		x	4		50
1-8		x			50
5-6	x		4		20
5-8		x	4		50
7-8	x		6		20
9-10	x		8		30
1-2	x				50
3-4	x			2	40
1-4	x				40
5-6	x			4	30
1-6	x				30
7-8	x			6	20
1-8	x				20
11-12	x		8	2	20
9-12	x		8		20

[4] All scores not indicated in the table are based upon 10 cases.

TABLE 19. INFLUENCE OF TWO DIRECTED TRIALS UPON TRIALS—HUMAN SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	36.9	7.4	16.70
H2 (3-4)	50.4	—6.1	—13.77
H2 (5-6)	43.0	1.3	2.93
H2 (7-8)	41.1	3.2	7.22
H2 (9-10)	35.6	8.7	19.64
H2 (11-12)	38.3	6.0	13.54

with most of our findings in regard to the performance of the animals. Since human subjects differ from animals, at least in the amount of their ideational content, our explanations of this difference in results need not, then, be couched wholly in gross senso-ri-motor terms. Guidance in the initial trials prevents the formation of some bad habits and enters little into conflict with habits

already set up. In the later trials, when the maze habit is fairly well fixed, the control, while perhaps causing some confusion, does call the attention of the alert and analyzing human subject to certain of the critical elements of the situation. The location of the troublesome elements in the problem aids in a rapid adjustment. In the trials succeeding the first few, on the other hand, when the reaction is, at best, in a fluid state and cues have little meaning, changes in the situation tend to disrupt the proper habits that are in the process of fixation. Temporary hypotheses in regard to the correct path are demonstrated invalid, not because they were not in the first place proper, but because of the changing conditions of which the subject is not informed.

Whether the slight decline in the saving exhibited by group H2 (11-12) as contrasted with H2 (9-10) is a chance occurrence or a tendency that would clearly define itself were guidance interpolated at a number of positions subsequent to the twelfth trial, we can not say. A decrease in effectiveness, however, one would be justified in expecting. By the tenth trial, habits have, presumably, become so well ingrained that much of their plasticity has been lost. Guidance, at this stage or later, is more likely to be confusing, in certain of its aspects, than if it were introduced slightly earlier, although its total effect may still be favorable.

Influence upon errors (Table 20): The total error scores show a tendency similar to that manifested in the trials. Initial guidance and the directed series located latest in the trial sequence are beneficial in their effects; control in the intermediate position is detrimental, or only slightly favorable. The large saving in group H2 (1-2) is significant. It supports the doctrine that it is better to avert bad habits than to disrupt them mechanically or call attention to them later in the learning.

The tendencies apparent in the scores indicating the immediate influences of the control are somewhat different from those evidenced in the scores made by the animals. The large saving in the return errors when guidance occurs early in the learning is one noteworthy deviation from the results obtained in the experiment upon rats. The stylus maze has, probably, difficulties for man that the large maze does not present to the animal. The turns in the

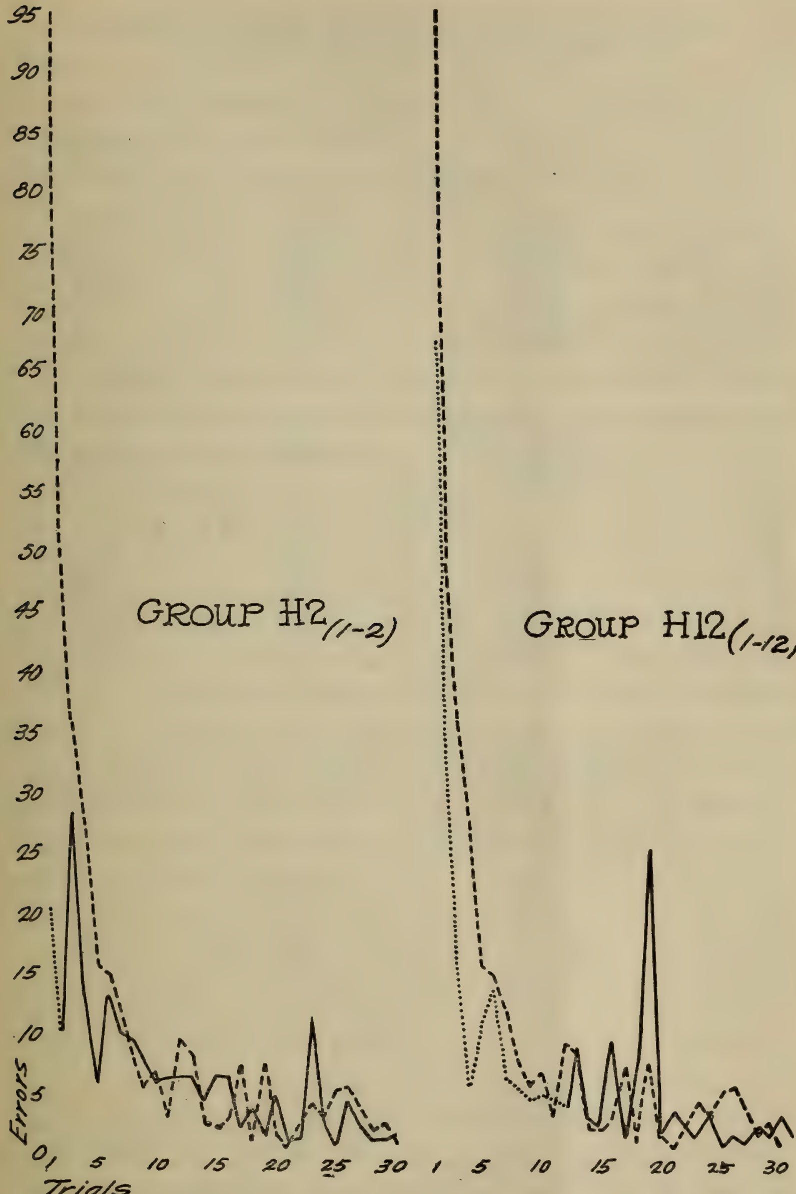

FIG. 4. A limited section of the error curve of groups H2 (1-2) and H12 (1-12) is shown superimposed upon the error curve of the unguided group. The dashes denote the unguided group; the dots, the guided trials of the guided groups; the solid line, the unguided trials of the guided groups.

TABLE 20. INFLUENCE OF TWO DIRECTED TRIALS UPON ERRORS—HUMAN SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	289.5	104.2	26.47
H2 (3-4)	410.2	—16.5	—4.19
H2 (5-6)	427.6	—33.9	—8.61
H2 (7-8)	378.3	15.4	3.91
H2 (9-10)	367.8	25.9	6.58
H2 (11-12)	355.5	38.2	9.70

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	39.15	17.20	30.53
H2 (3-4)	11.55	13.65	54.18
H2 (5-6)	9.68	1.94	16.84
H2 (7-8)	8.72	—1.94	—28.61
H2 (9-10)	9.57	—5.82	—155.20
H2 (11-12)	3.80	.35	8.43

C.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	2.19	—.46	—26.59
H2 (3-4)	1.50	.04	2.60
H2 (5-6)	1.67	—.36	—27.48
H2 (7-8)	1.29	—.08	—6.61
H2 (9-10)	1.36	—.18	—15.25
H2(11-12)	1.16	—.18	—18.37

D.

Group	Av.No.of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	3.39	—.51	—17.71
H2 (3-4)	3.28	—.88	—36.67
H2 (5-6)	2.74	—.89	—48.11
H2 (7-8)	2.06	—.46	—28.75
H2 (9-10)	1.75	—.41	—30.59
H2 (11-12)	1.52	—.18	—13.43

true pathway offer little obstruction to the rat; but to the human subject who is deprived of his faithful servant, vision, and is little at ease when relying entirely on contact or kinaesthesis for guidance, the small corners and turns of the true pathway, for no very small number of the early trials, act as effectively as obstructions to his progress as do the blind alleys. For minutes at a time he will work the stylus back and forth in a path that should offer him no resistance. Hence, the tendency to complete retracings in the cul-de-sac-less maze is not exhibited in the early trials, as it is in the case of the rats. Since, therefore, returns are not likely to be encouraged by the absence of cul-de-sacs, and no fixed habits are interfered with by the control, the marked relative saving in the initial trials is to be expected.

The distracting phase of the control's influence, as in the experiment upon animals, is on the ascendency, relatively at least, in the later trials. It is reasonable to suppose that the later the interpolation of the guidance occurs, and the more fixed the habits with which it enters into conflict, the more disturbing it will be. The positive saving in return errors exhibited by group H2 (11-12), which is an exception to the principle just enunciated, has the earmarks of a chance result. The fact that the normal score for the eleventh and twelfth trials is higher than that for the ninth and tenth is scarcely in accord with what we know of the learning process. Were the normal score for the eleventh and twelfth trials lower, or even the same as that for the ninth and tenth runs, an increase in return errors would have been exhibited.

Unlike the immediate effect of the control, the subsequent influence upon the errors amassed per trial is deleterious, and deleterious almost without exception. Cul-de-sac errors, moreover, are not spared; but it is worthy of note that the average number of cul-de-sac errors made per trial in the post-control period does not, in general, exhibit so large a relative increase over the normal as do the return errors. No very regular relation is apparent in the realm of cul-de-sac errors between the degree of relative detriment and the position of the guided series. From the point of view of the return errors amassed in the period following the directed

trials, the initial position and that latest in the trial sequence are the least detrimental.

This increase in errors over the normal in the human records, as contrasted with those of the rats', is, doubtless, a partial result at least, of the fact that the stylus maze entails such infinitely more delicate coördinations than does the large maze used for the animals that slight alterations are far more disrupting and not readily adjusted to. The human subject, moreover, was not informed that he was being guided. In his analyses, undoubtedly, the change in cues—when it is consciously recognized—is interpreted as the result of a false tracing or the entrance into regions yet unexplored. He declares himself "lost." A re-examination of the whole situation is attempted. This results, in the case of the short series, in much vain wandering and the deleterious habits dependent thereon. It must be remembered, however, that, in spite of this distracting effect of the control, a perfect adjustment to the maze situation is accomplished in fewer trials than normally.

Influence upon time (Table 21): The effect of guidance upon the total time required for mastering the problem is positive in all cases but one. The benefit, on the whole, however, is very slight. The only reduction in time of considerable size is effected by control interpolated late in the trial sequence.

The immediate influence of directed learning upon time is, in general, favorable. In the case of interpolated guidance there is a suggestion of a tendency for the relative saving in time during the period of control to decrease as the distance of the directed trials from the initial run is increased. The same tendency was present in the realm of return errors. Group H2 (11-12), in the case of both time and errors, exhibits a marked deviation from the general trend.

The subsequent effect of control upon the time consumed per trial is, in most cases, unfavorable, or so slightly favorable that it is of little significance. It is important to note, however, that guidance occurring within the first six trials has a very deleterious influence, whereas that occurring in the next six is less disturbing. The reason is not apparent. It is possible that at an early stage of the learning, when concepts are just taking form, alteration of

TABLE 21. INFLUENCE OF TWO DIRECTED TRIALS UPON TIME—HUMAN SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	1573.69	33.72	2.10
H2 (3-4)	1569.12	38.29	2.38
H2 (5-6)	1759.48	—152.07	—9.46
H2 (7-8)	1587.92	19.49	1.21
H2 (9-10)	1389.19	218.22	13.57
H2 (11-12)	1479.50	127.91	7.96

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	199.85	50.40	20.14
H2 (3-4)	61.31	40.72	39.91
H2 (5-6)	49.07	2.92	5.61
H2 (7-8)	38.42	2.52	6.22
H2 (9-10)	41.07	—9.42	—29.76
H2 (11-12)	22.55	8.81	28.09

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	35.84	—11.04	—44.52
H2 (3-4)	27.16	—4.16	—18.09
H2 (5-6)	27.79	—6.71	—31.83
H2 (7-8)	19.22	.69	3.46
H2 (9-10)	20.43	—1.63	—8.67
H2 (11-12)	18.20	—.28	—1.56

cues has a retarding effect upon speed. After, however, a general speed set has been established, the time required per trial may be little influenced by control. In fact, the slight increase in time exhibited by groups H2 (9-10) and H2 (11-12) in the post-control period may be explained in terms of the saving in trials and the consequent reduction in the practice which the subject gets in tracing the maze.

The curves reveal nothing that is not adequately depicted in the tables.

Conclusion: Control has a positive effect upon total trials, time and errors, when it is interpolated in the initial and latest positions, but is, generally speaking, detrimental in the intermediate position. The immediate effect of guidance is to reduce return errors in the early trials and to increase them above the normal in the later. The subsequent effect is to increase time and both types of error, but the degree of the detriment varies in no consistent way with the position of the control.

2. *Influence of Four Directed Trials Introduced at Various Positions in the Learning Process*

As in the experiment in which rats served as subjects, so here with the human subjects, a group was guided from the first to the fourth run, inclusive; another, from the fifth to eighth, inclusive; a third group, from the ninth to the twelfth run, inclusive.

TABLE 22. INFLUENCE OF FOUR DIRECTED TRIALS UPON TRIALS—HUMAN SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
H4 (1-4)	37.1	7.2	16.26
H4 (5-8)	43.7	.6	1.36
H4 (9-12)	37.5	6.8	15.35

Influence upon trials (Table 22): The influence of guidance extending over four successive runs and interpolated as described in the preceding paragraph, is manifested in a form similar to that displayed in the two-trial series. Initial guidance and that occurring latest in the trial sequence are about equally effective in reducing the number of trials; whereas the influence of control in the intermediate position upon trials is practically negligible. So considerable a deviation from the results of the experiment with animals, where the per cent of saving varies inversely as the distance of the guided series from the initial trial, is significant. It is possible, as we have previously indicated, that in the

intermediate stage of the learning, when hypotheses are being formed, a limited amount of control is very confusing. In the later trials, when the subject has become well oriented, the control, even though causing temporary confusion or systematic explorations, does, after all, indicate rather forcibly to the subject the troublesome elements in the situation and facilitates a rapid adjustment.

Influence upon errors (Table 23): The effect of guidance, from the point of view of the saving accomplished in the total number of errors made, varies inversely as the distance of the directed series from the beginning of the learning. The control introduced latest proves even detrimental. This is in striking contrast to the large saving in trials accomplished by the control thus interpolated. A probable explanation of this combination of effects was indicated in the discussion of the influence of guidance upon trials. The subject may be puzzled by the alteration of the situation, incident upon the introduction and removal of the control, may instigate somewhat systematic explorations and make many errors; but the critical elements of the situation have been called into the focus of his attention through the agency of the guiding device and conditions are ripe for a ready adjustment. Control occurring early in the learning, furthermore, when wandering is prevalent, has many more opportunities for preventing errors than that interpolated later.

The ranking of the groups in terms of the per cent of saving in return errors during the period of control is the same as that on the basis of total errors. The ascendency of the distracting phase of the control's influence, as the position of the directed runs is well removed from the beginning, is again evident; *i.e.*, the return error scores show a saving which varies inversely as the distance from the initial trial at which guidance is introduced. The large saving, when guidance is introduced in the initial trial, is noticeably contrary to the findings in the experiment in which rats served as subjects. The probable reason for the difference we have suggested in our discussion of the effect of two directed trials upon learning.

The subsequent influence of the control, considered both from

TABLE 23. INFLUENCE OF FOUR DIRECTED TRIALS UPON ERRORS—HUMAN SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
H4 (1-4)	255.0	138.7	35.23
H4 (5-8)	378.5	15.2	3.86
H4 (9-12)	417.6	—23.9	—6.07

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H4 (1-4)	33.55	4.36	11.50
H4 (5-8)	8.30	.67	7.47
H4 (9-12)	5.81	—1.06	—22.23

C.

Group	Av. No. of Cul-de-sac Errors per Trial in Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H4 (1-4)	1.38	.16	10.31
H4 (5-8)	1.68	—.47	—38.84
H4 (9-12)	1.63	—.65	—66.32

D.

Group	Av.No.of Return Errors per Trial in Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H4 (1-4)	1.80	.60	25.00
H4 (5-8)	1.84	—.24	—15.00
H4 (9-12)	2.92	—1.58	—117.91

the point of view of cul-de-sac and return errors, becomes unfavorable, as the position of the guided series is shoved farther along in the learning. Guidance in the initial trials has a positive subsequent effect upon errors; the two other positions result in an increase in errors above the normal. An absolute, as well as

relative increase in errors per trial is, in general, manifested, the later the interpolation of the directed series. The large positive saving in trials for group H4 (9-12), then, becomes very significant, since it indicates that, in spite of a great disruption, rapid adjustment can take place.

Since in the records based on the performance of human subjects the subsequent effect of control is not consistently of greater relative magnitude in the realm of cul-de-sac than return errors, we must look for principles other than, and, perhaps, less mechanical than, the one of repetition which we used to explain the behavior of rats. Repetition may be a factor, but it is no longer the dominant one in producing the results. Ideational control is a possible factor. After an individual has succeeded in attaining the goal several times, he develops an idea of the general direction of the course he must pursue. When cues are altered and exploration follows, the reaction is likely to be more unfavorable—provided the subject does not become badly confused or completely lose himself—upon cul-de-sac errors than upon return errors, for, knowing in general the direction in which the goal is to be sought, the subject is loath to turn back on his path.

The error curves do little more than confirm the tabular evidence. In the period of control, the curve for group H4 (1-4) lies well below the normal, whereas in the post-control period, its general course differs little from the normal. The curve of group H4 (5-8) (Figure 5), on the other hand, exhibits steeples of medium height in the first seven trials of the post-control period, whereafter it follows the normal rather closely. These steeples carry it above the normal. The curve for group H4 (9-12) (Figure 5) has, immediately following the period of guidance, one very large steeple and one small one before it falls rapidly and regularly to about the level of the normal curve. Its subsequent course is slightly irregular. The enormous steeple coincides with what we have previously referred to as the period of somewhat systematic exploration. The curves, then, indicate longer wavering and less rapid adjustment when direction is given in the intermediate position; but more severe and shorter-lived confusion, when control is introduced late in the learning.

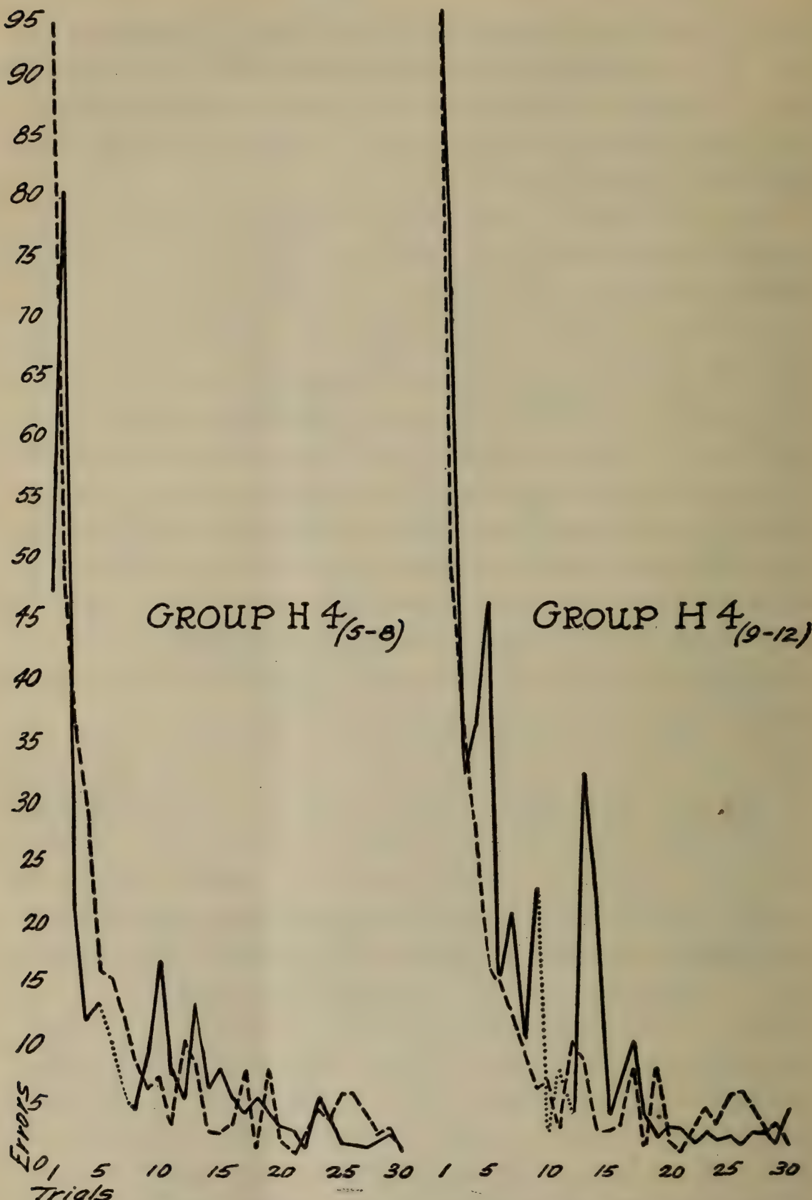

FIG. 5. A limited section of the error curve of groups H4 (5-8) and H4 (9-12) is shown superimposed upon the error curve of the unguided group. The dashes denote the unguided group; the dots, the guided trials of the guided groups; the solid line, the unguided trials of the guided groups.

Influence upon time (Table 24): The scores indicating the total time required by the guided groups to master the problem exhibit only a slight saving over the time scores of the normal group. The immediate effect of the control in all positions is a positive saving, and the initial position seems the most favorable condition. The time per trial for the trials of the post-control period is, on the other hand, in the case of each directed group, in excess of the normal. The increase in time, over that of the normal, manifested by Group H4 (1-4), in spite of the decrease in errors, is significant.

The time curves in their relation to the normal in the post-control period resemble the error curves so closely, a discussion of them will be of no value.

Conclusion: In general, the effect of guiding four of the trials results in a slight but positive saving in the realm of total trials, total time and total errors. The immediate effect upon return errors varies inversely as the distance of the directed runs from the initial trial. This same inverse relationship between errors and the distance of the period of guidance from the initial stage of the learning holds for all of the error scores of the post-control period, as well as for the total number of errors amassed during the complete learning process. The intermediate position is least favorable to a reduction in trials, most favorable to a reduction in total time. The initial and final positions have about the same value, so far as these latter two measures are concerned. The immediate effect is to decrease the time; the subsequent effect is to increase the time consumed per trial.

TABLE 24. INFLUENCE OF FOUR DIRECTED TRIALS UPON TIME—HUMAN SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
H4 (1-4)	1548.63	58.78	3.66
H4 (5-8)	1597.22	10.19	0.63
H4 (9-12)	1566.48	40.93	2.57

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H4 (1-4)	149.92	17.60	10.50
H4 (5-8)	42.17	3.63	7.09
H4 (9-12)	32.73	3.46	9.57

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H4 (1-4)	28.55	—5.55	—24.12
H4 (5-8)	22.90	—2.99	—15.02
H4 (9-12)	21.77	—3.85	—21.48

3. *Influence of Six Directed Trials Introduced at Various Positions in the Learning Process*

Only two groups of human subjects were granted series of six directed trials. One group was guided from the first to the sixth trial, inclusive; the other group, from the seventh to the twelfth run, inclusive.

Influence upon trials (Table 25): Unlike the groups guided for the initial two or four trials, the saving in trials for group H6 (1-6) is practically negligible, and is far exceeded by the saving in the group guided in the later trials. The apparent ineffectiveness, so far as trials are concerned, of control doled out during the initial six runs, is significant, especially since, in the experiment conducted upon the rats, control in the initial six trials was the

TABLE 25. INFLUENCE OF SIX DIRECTED TRIALS UPON TRIALS—HUMAN SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
H6 (1-6)	43.6	.7	1.58
H6 (7-12)	37.1	7.2	16.24

most favorable condition for learning. Again we seem forced to seek an explanation in ideational terms. The six-trial series is apparently sufficiently long to permit the subject to develop a vague concept of the maze and a fair amount of confidence in his own procedure. When he does go astray, upon the removal of the controlling device, an emotional tone in the form of a feeling of discouragement becomes very pronounced and a vain search for the lost cues is instigated. This search, with its unsatisfied desire, tends to hinder a rapid and complete adjustment to the maze situation.

The same explanation for the saving in group H6 (7-12) as was advanced to account for the reduction in the number of trials required for learning in group H4 (9-12), may be offered. Repetition of the discussion is unnecessary.

Influence upon errors (Table 26): Although the adjustment is slower in the case of group H6 (1-6) than in group H6 (7-12), the saving in total errors is considerably greater. This saving, an inspection of the records reveals, is a result of the immediate physical effect of the control, and of control in the very early trials, especially.

The negative saving in the number of return errors accumulated during the period of control by group H6 (1-6), in contrast to the positive saving exhibited by group H6 (7-12), is significant. It is probably indicative of the operation of the same factors which produced the accentuation of the retracing reaction in the case of the animal groups guided for the initial two, four and six trials. Wandering characterizes the early stage of the learning. As soon as some familiarity with the maze is attained and the turns of the true path no longer act as barriers, the exploratory activities on

TABLE 26. INFLUENCE OF SIX DIRECTED TRIALS UPON ERROR—HUMAN SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
H6 (1-6)	334.8	58.9	14.96
H6 (7-12)	380.3	13.4	3.40

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H6 (1-6)	30.52	—3.76	—12.32
H6 (7-12)	3.95	1.35	25.61

C.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H6 (1-6)	1.75	—.44	—33.59
H6 (7-12)	1.16	—.18	—18.36

D.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H6 (1-6)	3.53	—1.68	—90.81
H6 (7-12)	1.45	—.11	—8.21

the part of the guided subjects manifest themselves largely in long retracings which are unhampered by entrances into cul-de-sacs, as in the case of the unguided subjects.

Normally, the early stages of the learning are characterized by a rapid decline in return errors. The subject develops a notion of the general direction of the goal and some confidence in his procedure. Consequently, when control is interpolated after the sixth

trial, the simplification of the maze pattern operates principally to decrease below the normal the retracings.

The subsequent effect upon errors is negative in both types of error, thus indicating that the distraction resulting from alteration of cues rather than any beneficial effect of the control is dominant. Group H6 (1-6) suffers more than group H6 (7-12).

The error curve for group H6 (1-6) (Figure 6) through practically its entire course lies above the normal. Immediately subsequent to the guided trials a very large steeple appears. This is followed by a sudden drop in the curve and a series of smaller steeples whose general level is considerably below that of the first steeple, but still somewhat above the normal curve. These irregularities persist for about twenty trials. The curve drops to the normal level at about the thirty-sixth trial. The curve for group H6 (7-12) (Figure 6), on the other hand, lies below the normal

TABLE 27. INFLUENCE OF SIX DIRECTED TRIALS UPON TIME—HUMAN SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
H6 (1-6)	1705.75	—98.34	—6.12
H6 (7-12)	1571.79	35.62	2.22

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H6 (1-6)	136.74	—21.12	—18.27
H6 (7-12)	25.90	11.96	31.59

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H6 (1-6)	27.27	—6.19	—29.36
H6 (7-12)	22.48	—4.56	—25.45

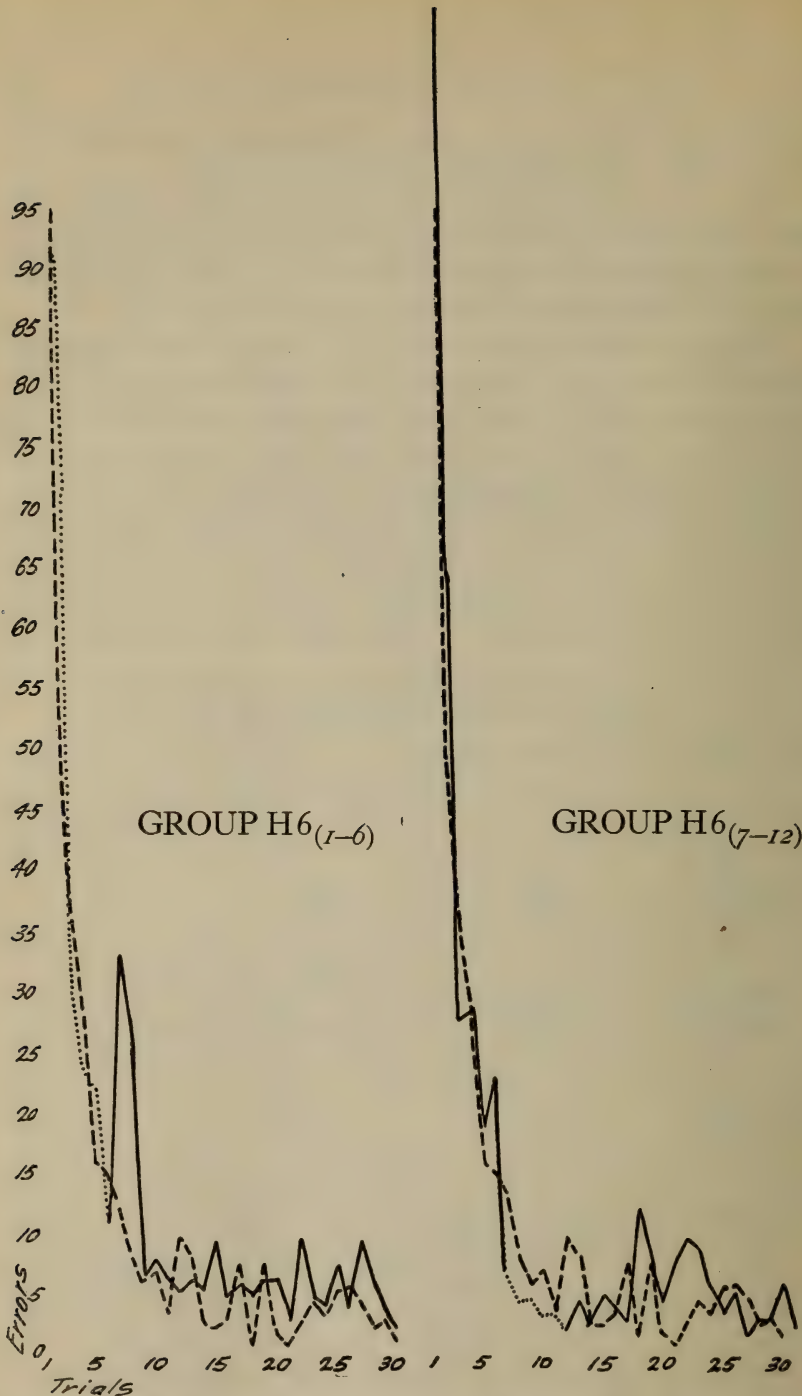

FIG. 6. A limited section of the error curve of groups H6 (1-6) and H6 (7-12) is shown superimposed upon the error curve of the unguided group. The dashes denote the unguided group; the dots, the guided trials of the guided groups; the solid line, the unguided trials of the guided groups.

in the control period and exhibits small steeples with a generally rising level in the first twelve trials of the post-control period. Like the preceding curve, it joins the normal at about the thirty-eighth trial.

Since the time scores reveal nothing very significant, we shall forego a discussion of them.

Conclusion: Six directed trials result in a small saving in both trials and total errors. The immediate effect of initial control is to increase the return errors above the normal; whereas that of interpolated control is to decrease the return errors. The subsequent effect of the guidance is to increase above the normal the time and errors per trial.

4. *Influence of Eight Directed Trials Introduced at Various Positions in the Learning Process*

Series of eight successive guided trials were introduced upon the first and upon the ninth trial.

TABLE 28. INFLUENCE OF EIGHT DIRECTED TRIALS UPON TRIALS—HUMAN SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
H8 (1-8)	57.4	—13.1	—29.58
H8 (9-16)	37.1	7.2	16.36

Influence upon trials (Table 28) : Guidance in the initial runs increases above the normal the trials required to learn the maze, whereas control interpolated late reduces the number of trials considerably. The scores agree well with the general tendency manifested in the case of the six-trial groups, and must be accounted for upon the same principles. The tendency, on the contrary, differs radically from that observed in the case of the animals.

Influence upon errors (Table 29) : Both groups exhibit a positive saving in the total number of errors made. Group H8 (9-16), although requiring fewer trials than group H8 (1-8), nevertheless ranks second in merit, when the total number of errors accumu-

TABLE 29. INFLUENCE OF EIGHT DIRECTED TRIALS UPON ERRORS—HUMAN SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
H8 (1-8)	326.4	67.3	17.09
H8 (9-16)	362.7	31.0	7.87

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H8 (1-8)	19.76	0.00	0.00
H8 (9-16)	1.70	1.81	51.57

C.

Group	Av. No. of Cul-de-Sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H8 (1-8)	1.28	—.07	—5.79
H8 (9-16)	1.03	—.24	—30.38

D.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H8 (1-8)	1.57	.03	1.88
H8 (9-16)	2.16	—.86	—66.15

lated is used as a measure. The greater efficacy of initial guidance in reducing the total number of errors was apparent, also, in the case of the six-trial series. It is, doubtless, the result largely of no subtler agency than the physical prevention of cul-de-sac errors during the extended wanderings which characterize the early runs.

The immediate influence of guidance, however, upon return

errors is relatively greater in the case of group H8 (9-16) than group H8 (1-8). Barring from consideration the fact that an increase in return errors is not exhibited by group H8 (1-8), one can note a striking resemblance in regard to the relation of the immediate effect of control granted early and late in the learning, between the six- and eight-trial series. The absence of an increase in return errors in the case of group H8 (1-8), as contrasted with group H6 (1-6), is, doubtless, the result of the interaction of a number of factors; *i.e.,* a saving in the very early trials, a loss in the few trials following these early runs (both of these we have previously described), and a saving again, perhaps, in the seventh and eighth trials, as a result of the conquest of the retracing habit. A counterbalancing of factors, rather than the absence of any influence, produces the score in return errors which exactly equals the normal.

The general effect upon the errors made per trial in the post-control period is deleterious, but only decidedly so when guidance is given late in the learning. Let it be noted that, in spite of the increase in errors, the number of trials required by group H8 (9-16) is less than that required by group H8 (1-8) or the normal group.

The curves give some interesting data upon the nature and persistence of the control's influence not revealed in the tables. For seven trials immediately following the removal of the guiding device the curve for group H8 (1-8) runs along rather regularly, considerably below the level of the normal curve. Then follows a period of large steeples extending over about nine trials, whereafter the curve descends irregularly and slightly above the normal.

This apparent occurrence of great confusion considerably after the period of control seems typical of the groups directed for long periods in the early stages of the learning, for the group guided during the initial twelve trials reveals a similar tendency (Figure 4). The phenomenon can be easily explained. Much control early in the learning builds up confidence and well established habits. The confidence is sufficient to create indifference with respect to the slight suspicions aroused by the altered cues which attend the removal of the controlling device. These suspicions grow, in the

trials that follow, because the strangeness persists. Then chance entrances into cul-de-sacs reveal a multitude of possibilities to the unsuspecting subject who seeks in them new and shorter routes to the goal. He becomes confused and almost hopelessly lost. Long after a readjustment is well afoot, waverings are apparent. Hence the reason for the irregularity of the curve in its final stages is apparent.

The curve for group H8 (9-16) in the post-control period is not very dissimilar to that of group H8 (1-8). A small steeple follows immediately the control period, then a low course is maintained for seven trials, whereupon a decided rise (larger than any previous steeple) persists for four trials. The later sections of the curve are more irregular than the normal. The disturbance is apparently not so great when guidance occurs later in the learning, as it is when control is granted in the early runs. The phenomenon is probably the result of the fact that the reagent has had some previous experience with the cul-de-sacs, knows a little concerning their fatal character, and seeks not within them, with much fervid conviction, the desired short route.

The irregularity of both curves in the post-control period reflects the persistent doubt and uncertainty resulting from the conflict of two rather well established forms of reaction.

Conclusion: Guidance extending over the initial eight trials tends to increase above the normal the number of trials and the total time required; control in the later runs reduces both trials and time. Both the initial and interpolated guidance accomplish a saving in total errors, the saving being greater in the case of initial control. The immediate effect of control is positive in the case of both time and errors, whether guidance be given early or late in the learning period, but relatively greater when control is given late. The subsequent effect of guidance is to increase above the normal the number of errors made per trial. The negative saving in errors per trial in the post-control period is greater when control is interpolated late in the trial sequence than when it occurs early.

TABLE 30. INFLUENCE OF EIGHT DIRECTED TRIALS UPON TIME—HUMAN SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
H8 (1-8)	1563.03	44.38	2.76
H8 (9-16)	1554.15	63.26	3.94

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H8 (1-8)	74.58	7.62	9.27
H8 (9-16)	24.31	5.68	18.94

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H8 (1-8)	17.98	1.93	9.69
H8 (9-16)	21.21	—4.52	—27.08

SUMMARY

A. Results of Experimentation upon Animals:

1. The efficacy of a given number of guided trials is a function of their position.

2. The efficacy of the control as an agent for reducing the number of trials required to master the problem varies, as a rule, inversely as the distance of the guided series from the initial trial.

3. The influence of guidance in the realm of total errors is beneficial; but, in general, as the distance of the guided series from the initial trial increases, the total number of errors increases. When the directed series is very short, however, the intermediate position is the most favorable and it is only slightly less favorable than the initial position when the series are of medium length.

4. The immediate effect of control is to prevent cul-de-sac errors. The number prevented varies inversely as the distance of the series of directed trials from the initial run, and directly as the length of the series. The explanation of the fact harks back to the nature of the learning process.

5. The relative saving in the number of return errors amassed during the period of control which occurs in an intermediate position is always positive and, in general, greater than for any other position.

6. Short series of guided trials in the initial position increase above the normal the number of return errors made in the period of guidance, whereas the longer series in the same position result in a saving in return errors.

7. The immediate effect of control in the position most distantly removed from the beginning is not entirely unambiguous; *i.e.*, a reduction in return errors may or may not be effected. In general, however, the relative saving is less than that accomplished by control in the intermediate position.

The results indicating the immediate effect of guidance are the outcome of the interaction of factors both detrimental and advantageous. It seems well, even at the risk of accusations of prolixity, to summarize the factors suggested to account for the records made during the period of control.

The increase above the normal of the return errors amassed per trial in the shorter periods of control in the initial position, we have attempted to explain on the basis of the facilitation of complete retracings resulting from the absence of cul-de-sacs. This deleterious effect upon return errors is balanced in the longer series by the rapid attainment of a well-nigh complete mastery of the simple cul-de-sac-less maze and the consequent almost total elimination of the retracing errors in the later trials of the series. In positions other than the initial, the immediate influence of the control upon return errors is the result of a balance between the benefit derived from the prevention of cul-de-sacs, and simplification of the problem, on the one hand, and confusion or distraction attendant upon the alteration of cues already integrated into habits of various degrees of strength, on the other. The detrimental

phase of the control's influence is on the ascendency, though not always dominant, in those positions of the directed trials most distantly removed from the beginnings of the learning.

8. The saving in the number of cul-de-sac errors made per trial in the post-control period is, with one exception, positive and is, generally, greater than the saving in return errors.

9. The subsequent effect of a small amount of guidance (two or four trials) upon cul-de-sac errors is relatively greatest in the case of the groups whose period of control was introduced in an intermediate position, whereas the subsequent effect of larger amount is the most favorable when guidance occurs in the initial position.

10. The number of return errors amassed per trial in the post-control period by the groups given short periods of initial guidance or short periods of control introduced late in the learning is greater than that amassed by the normal group. The intermediate position is most favorable or least unfavorable in its subsequent effect upon return errors when the period of guidance is limited; the initial position is the most favorable when the period of control is rather extended.

The subsequent effect of control is a balance between the benefit resulting from the formation of proper habits, the prevention of the formation of undesirable reactions, the marking of the critical elements in the situation, on the one hand, and the confusion attendant upon the alteration of cues, on the other. A very limited amount of guidance in an intermediate position, when habits are plastic, merely calls attention to the critical elements of the situation and enters little into conflict with well established modes of behavior. Control interpolated late in the learning may enter into conflict with reactions to the maze that have been thoroughly ingrained.

11. Control usually results in a reduction in total time. The amount of reduction tends to vary inversely as the distance (within limits) of the directed trials from the initial run.

12. The immediate effect of guidance upon time is, in most cases, positive and is relatively greatest when control is introduced in the intermediate positions. The time per directed trial, when the

series is short and interpolated late in the learning, is greater than the normal.

13. The subsequent effect of little guidance upon the time consumed per trial is unfavorable. The intermediate position is, generally speaking, the least detrimental or the most favorable in its influence. Long periods of control tend to reduce the time per trial in the post-control period, especially when guidance occurs in the initial runs.

B. Results of the Experimentation upon Human Subjects:

1. The efficacy of a given amount of control is conditioned by the position in the learning at which it is introduced.

2. Control, if properly placed, accomplishes a reduction in the number of trials necessary for learning the maze. Generally speaking, its efficacy varies directly as its distance from the early trials. The exception to the general rule occurs in the case of short periods of initial guidance which are equal in effectiveness to periods of similar length interpolated later in the learning.

The divergence of these results from those derived in the experimentation upon animals we have accounted for largely in terms of ideational control. When the reaction to the situation has so shaped itself that the alteration of cues can be recognized with some confidence and attention can be consciously directed to the critical elements of the situation, then guidance, though causing exploration, may be effective in bringing about a rapid adjustment. The modification of the cues in the trials immediately following the first few merely counteracts the favorable aspects of the control's influence by injecting confusion into a reaction which is just losing its polymorphic character. Little guidance in the initial position is beneficial because it does prevent the formation of some unfavorable habits and is withdrawn before cues dependent upon it are integrated with any fixity into the sensory and ideational content.

3. The effect of control, measured in terms of total errors, is usually favorable and, generally speaking, varies directly with the distance of the guided trials from the initial runs. The exception to this general rule occurs in the case of very little guidance ad-

ministered rather late in the learning process. This condition is very efficacious.

4. The rapidity of adjustment may vary independently of the total number of errors accumulated.

5. The immediate effect of control is, in most cases, favorable. The relative saving in return errors effected by the longer groups of guided trials varies directly with the distance of the controlled runs from the initial trial. The reverse is true for the short series.

The saving in the number of return errors amassed during the period of control, when the directed runs are few and occur in the early trials, we have attempted to account for on the basis of the simplification in the problem which results from the absence of cul-de-sacs, as well as the improbability of complete retracings because of the barrier-like character, in the early stages of the learning, of the turns in the true pathway. Little guidance later in the learning, on the other hand, has a deleterious immediate effect because it alters cues well integrated into the individual's reactions and it is not sufficiently extended to permit an effective readjustment to the modified situation. The longer groups of directed trials, interpolated late, permit this almost complete readjustment with its resultant benefit.

A possible explanation of the increase in return errors per directed trial when the period of initial guidance is rather extended, has been hinted at in the preceding discussion. As soon as the barrier-like effect of the turns in the true pathway has been overcome—and this occurs early in the learning—control tends temporarily to facilitate retracings.

6. The subsequent effect of guidance upon cul-de-sac, as well as upon return errors, is usually detrimental, although the degree of detriment varies in no consistent way with the position of the control.

7. Control, in its subsequent effect upon errors, is not selective, as it was in the case of the animals. Its influence is as unfavorable upon cul-de-sac as upon return errors.

The subsequent effect of control we have attempted to describe as a resolution of the influences of such unfavorable factors as the distraction attendant upon the removal of the controlling de-

vice, the retracing habit established in the period of control, and voluntary explorations concomitant with elaborate analyses, on the one hand, and the effects of such favorable factors as the formation of proper habits and bringing to the attention of the subject the critical elements of the situation, on the other. The former group are usually dominant.

The assumption of a relatively analytical mode of attack on the problem by the human subjects, in contrast to the animal, seems not an unreasonable partial explanation, at least, of the differences in the behavior of the two groups. The method of distributing effort in the two experiments, moreover, may also have been no small factor in producing the variations in the results. The question needs experimental investigation.

8. The effect of control upon the total time required to master the problem is slight but usually favorable. The time scores for the period of control vary with the position of the guided trials in about the same way as do the error scores. The subsequent effect of control upon time is not sufficiently regular in its manifestations to permit a generalization.

III

THE RELATIVE EFFICACY OF VARIOUS AMOUNTS OF CONTROL

It is the purpose of this chapter to present a description and analysis of the influence upon learning of various amounts of guided effort. Although it is obviously impossible to separate entirely the influence of the amount from the influence of the position of the guidance, it seems desirable, nevertheless, to compare the behavior of those groups of animals which have had the same amount of preparation previous to the period of control.

A. Results Based upon the Records of Animal Subjects

The investigation in which animals served as subjects produced few data relevant to the topic of this chapter other than those which will furnish a basis for a consideration of the question of the relative effectiveness of various amounts of initial guidance. A comparison, however, of the influence of series of four and eight directed trials introduced upon the fifth run, is possible.

1. *The Influence of Various Amounts of Initial Guidance*

Let it be recalled that groups 2 (1-2), 4 (1-4), 6 (1-6), 8 (1-8), and 12 (1-12) were guided, respectively, for the initial 2, 4, 6, 8, or 12 trials. A consideration of the behavior of these groups will constitute the programme of this section.

Influence upon trials: Guidance in the initial position, regardless of the amount, is effective in reducing the number of trials necessary to attain a mastery of the maze (see Table 31). The efficacy of the control, however, increases as the amount of guidance is increased from two to six trials, but decreases again as the length of the guided series is extended to eight and twelve runs. In other words, there is an optimum amount of guidance beyond which the efficacy of the control decreases rapidly.

TABLE 31. INFLUENCE UPON TRIALS OF VARIOUS AMOUNTS OF GUIDANCE IN THE INITIAL POSITION—ANIMAL SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	25.5	8.3	24.6
4 (1-4)	22.0	11.8	34.9
6 (1-6)	15.5	18.3	54.14
8 (1-8)	19.9	13.9	41.12
12 (1-12)	24.1	9.7	28.69

Influence upon errors: The relative efficacy of various amounts of control in the initial position is the same in the realm of total errors as in the realm of trials (see Table 32). The per cent of saving increases as the number of directed trials is increased to six, and decreases slightly when more than six controlled runs are given.

The immediate effect of various amounts of guidance in the initial position upon the number of return errors made per trial we have already briefly indicated in the previous chapter. The influence of little control upon the number of return errors made per directed run is deleterious, and the degree of detriment increases as the length of the guided series is extended from two to six runs. More than six directed trials, however, effect a reduction in the number of return errors amassed per trial during the period of control.

Since the scores indicating the immediate effect of control in each series are, in part, based upon the records of all of the series shorter in length, the relative influence of each two successive trials of the first twelve runs can be demonstrated or inferred from the average scores given. Control in the first two trials is unfavorable to the reduction of return errors. This result we have attempted to explain on the basis of the facilitation of complete retracings by the prevention of cul-de-sac errors. Guidance in the third and fourth trials is relatively more unfavorable to the reduction of return errors than in the first two runs, while control in the fifth and sixth trials accomplishes the most marked relative increase in the number of retracings. Control in the seventh

TABLE 32. INFLUENCE UPON ERRORS OF VARIOUS AMOUNTS OF GUIDANCE IN THE INITIAL POSITION—ANIMAL SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	143.22	16.93	10.57
4 (1-4)	99.90	60.25	37.62
6 (1-6)	69.73	90.42	56.46
8 (1-8)	71.53	88.62	55.34
12 (1-12)	81.33	78.82	49.22

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	22.11	—1.00	—4.74
4 (1-4)	14.54	—1.57	—12.10
6 (1-6)	10.87	—2.05	—23.24
8 (1-8)	5.84	1.08	15.67
12 (1-12)	3.28	1.34	29.00

C.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	2.12	—.14	—7.07
4 (1-4)	1.46	.85	36.79
6 (1-6)	.43	1.32	75.43
8 (1-8)	.45	1.16	72.05
12 (1-12)	.67	.62	48.06

D.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	2.00	—.88	—85.98
4 (1-4)	1.03	—.29	—39.18
6 (1-6)	.60	.28	31.82
8 (1-8)	.30	.43	58.90
12 (1-12)	.74	—.23	—45.09

and eighth trials—trials in which rapid progress is being made in the mastery of the simple cul-de-sac-less maze—effects a decrease in return errors which is sufficiently great to counterbalance the negative effects of control in the earlier trials and to produce, as a final result, an actual saving in the average number of return errors amassed per directed trial. Guidance from the eighth to the twelfth trial is, likewise, very effective in reducing the return errors made per controlled run.

The subsequent effect of control (Table 32) in the realm of cul-de-sac errors is, in general, to produce a diminution in the number amassed per trial. Group 2 (1-2) is an exception to this rule. The subsequent effect of the control upon cul-de-sac errors becomes beneficial and increasingly so, as the length of the guided series is increased to six trials, but the relative saving decreases slightly as the control is extended to eight and twelve runs. The same general relation between the amount of control and the number of cul-de-sac errors made per trial obtains, if we consider merely the cul-de-sac errors made by each of the groups in the trials following the twelfth.

A deleterious effect on the part of the control upon the return errors amassed per trial in the post-control period is apparent in the groups guided for two, four and twelve trials; six and eight directed trials, however, reduce the retracings. It is significant that, in each of the five cases, the relative benefit is greater, or the relative detriment less, in the realm of cul-de-sac than in the realm of return errors.

The probable factors determining the error and trial scores just described have been frequently indicated. In the diffuse reaction characteristic of the first few trials, guidance can do little to establish a tendency to follow the true pathway; yet it does encourage the formation of the retracing habit. When the cul-de-sacs are opened, after the short period of control, the animal that has a tendency to retrace, will be given plenty of opportunities to be enticed into the pitfalls. The unfavorable effects, then, of short series of directed trials introduced at the beginning of the learning process may be greater than those of series of intermediate lengths. The retracing habit, when the controlled series of trials is of inter-

mediate length, tends to decline in the later runs of the period of guidance, and proper habits are established. The reaction, moreover, at the time the control is removed is sufficiently plastic to suffer no great disruption by the alteration of some of the cues. The longer series, on the other hand, permit habits of considerable stability to develop. Alteration of cues is more likely to be disrupting under these circumstances than in the less extended series. Hence the reason for the relative superiority of series of medium length is apparent.

TABLE 33. INFLUENCE UPON TIME OF VARIOUS AMOUNTS OF GUIDANCE IN THE INITIAL POSITION—ANIMAL SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	1389.86	360.86	20.61
4 (1-4)	1298.97	451.75	25.80
6 (1-6)	1079.61	671.11	38.33
8 (1-8)	1076.73	673.99	38.50
12 (1-12)	1193.23	557.49	32.99

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	367.82	142.69	27.95
4 (1-4)	234.87	76.59	24.59
6 (1-6)	174.59	2.10	1.19
8 (1-8)	88.60	16.57	15.76
12 (1-12)	55.79	53.82	49.10

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
2 (1-2)	33.56	—11.72	—53.66
4 (1-4)	30.99	—9.62	—45.01
6 (1-6)	18.24	1.78	8.89
8 (1-8)	13.72	5.03	26.83
12 (1-12)	16.64	1.39	7.71

Influence upon time (Table 33): A discussion of the influence of initial guidance upon time will be omitted, since the time scores exhibit, in general, the same tendencies revealed in the error scores.

2. *Influence of Various Amounts of Guidance Introduced Upon the Fifth Trial*

The discussion of this section must be limited to a consideration of the effect of four and eight guided trials upon learning. Since the number of cases in each group is small, and since the data derived under only two different conditions are being compared, no great reliance can be placed on the results.

TABLE 34. INFLUENCE UPON TRIALS OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE FIFTH TRIAL—ANIMAL SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
4 (5-8)	28.1	5.7	16.90
8 (5-12)	26.8	7.0	20.71

Influence upon trials (Table 34): Eight directed runs introduced upon the fifth trial are slightly more effective in reducing the number of trials required to attain a mastery of the maze, than are four controlled runs.

Influence upon error (Table 35): From the point of view of the total number of errors amassed during the learning, four and eight guided trials are equally efficacious. This is significant, since the greater amount of control does result in a slight saving in trials. The result is attributable largely to the immediate effect of the guidance. The longer period of control accomplishes an increase in the number of return errors amassed per directed run, whereas the shorter does not. This relation is an anomaly for which the writer can offer no explanation except that of chance. One would expect, since the first four of the series of eight controlled trials exhibit a reduction in return errors, that four trials more of practice under unaltered conditions would produce a relative saving,

TABLE 35. INFLUENCE UPON ERRORS OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE FIFTH TRIAL—ANIMAL SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
4 (5-8)	107.71	52.44	32.74
8 (5-12)	107.71	52.44	32.74

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
4 (5-8)	2.89	.11	3.67
8 (5-12)	2.43	—.23	—10.45

C.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
4 (5-8)	1.01	.60	37.27
8 (5-12)	.70	.59	45.73

D.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
4 (5-8)	.57	.16	21.92
8 (5-12)	.50	.01	1.99

at least equal to that accomplished in the first four trials, if not greater.

The scores indicating the subsequent effect of control reveal that the longer period of control has a greater beneficial effect upon cul-de-sac errors than does the shorter, and that the reverse is true for the return errors. The same relation between the error scores of the two groups holds, if the performance in the trials beyond

the twelfth is considered. Evidently, then, any distraction attendant upon the alteration of cues which have had opportunity in the eight guided trials to become well integrated into the reaction, manifests itself largely in the realm of return errors. It is, also, probable that the persistence of the retracing habit established during the period of control is responsible for the small saving in return errors in the post-control period exhibited by group 8 (5-12), as contrasted with the saving manifested by group 4 (5-8).

TABLE 36. INFLUENCE UPON TIME OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE FIFTH TRIAL—ANIMAL SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
4 (5-8)	1547.30	203.42	11.61
8 (5-12)	1476.37	274.35	15.67

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
4 (5-8)	33.96	13.87	29.00
8 (5-12)	25.85	6.46	19.99

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
4 (5-8)	18.45	.30	1.60
8 (5-12)	14.32	3.71	20.58

Influence upon time (Table 36): The time scores indicate little that is not predictable from the scores in trials and errors. The saving in total time is slightly greater when more guidance is given than when the control is very limited. The average time per directed trial is less than the normal, but group 4 (5-8), contrary

to expectation, exhibits a greater relative saving than does group 8 (5-12). The relative saving in time per trial for the trials of the post-control period is greater for group 8 (5-12) than for group 4 (5-8). Apparently the greater distraction attendant upon the removal of the controlling device after the longer period of guidance is overbalanced by the increased facility in running resulting from the four extra directed trials given group 8 (5-12), as opposed to group 4 (5-8).

B. Results Based upon the Records of Human Subjects

1. *Influence of Various Amounts of Initial Guidance*

The groups of subjects whose records will furnish the data for the discussion of this section were guided for the initial 2, 4, 6, 8 or 12 trials.

TABLE 37. INFLUENCE UPON TRIALS OF VARIOUS AMOUNTS OF GUIDANCE IN THE INITIAL POSITION—HUMAN SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	36.9	7.4	16.70
H4 (1-4)	37.1	7.2	16.26
H6 (1-6)	43.6	.7	1.58
H8 (1-8)	57.4	—13.1	—36.09
H12(1-12)	45.7	—1.4	—3.16

Influence upon trials (Table 37): The effect upon learning, in the case of the human subjects, of groups of controlled trials of various lengths, when the period of guidance has not been preceded by any training, diverges greatly from that noted in the case of the animals. The efficacy of the control, from the point of view of its capacity to decrease the number of trials required by the human subjects to attain a mastery of the maze, varies, generally speaking, inversely as the length of the group of controlled runs. Eight and twelve directed runs even effect an increase above the normal in the number of trials needed for learning the problem. Whether the greater increase in trials exhibited by group

H8 (1-8), in contrast to group H12 (1-12), is a fair index of what would happen, were a much larger number of individuals considered, is a question. If the tendency indicated is representative, then we may say that the efficacy of the control decreases as the control is increased to a certain amount. If more guidance is given, however, the influence of control becomes less detrimental. Such a condition seems not at all improbable, in the light of the general tendencies observed in the error scores.

Influence upon errors (Table 38) : The influence of guidance in the initial position upon the total number of errors amassed is favorable, for a considerable reduction in errors is exhibited by each of the five groups under consideration. Short and long periods of guidance are most effective, however. It is significant that this result is diametrically opposite to that obtained in the experiment upon animals. The reduction in the total number of errors made by the groups guided for the longer periods is apparently the result of the prevention of the cul-de-sac errors by the controlling device, since the error scores for the post-control period, as well as the return error scores, for the period of guidance, and the trials scores are all higher than the normal.

The immediate influence of guidance upon return errors is favorable when the period of control is short; detrimental, when it is longer. In general, then, the efficacy of the directed runs varies inversely as their number. Group H8 (1-8) is slightly aberrant. The divergence of the results indicating the immediate effect of guidance from those exhibited in the animal records we have already attempted to explain in terms of the barrier-like function in the very early trials of the turns of the true pathway, with the consequent prevention, to a large degree, of retracings of any length. As soon as the subject is slightly familiar with the pathway, his behavior, so far as return errors are concerned, resembles that of the animals in the first few trials.

The third and fourth trials are less effective in preventing return errors than are the first two. In the fifth and sixth guided trials the return errors are greatly increased above the normal; in the seventh and eighth trials, they are again much reduced. It is possible, perhaps even probable, as previously suggested, that by the seventh

TABLE 38. INFLUENCE UPON ERRORS OF VARIOUS AMOUNTS OF GUIDANCE IN THE INITIAL POSITION—HUMAN SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	289.5	104.2	26.47
H4 (1-4)	255.0	138.7	35.23
H6 (1-6)	334.8	58.9	14.96
H8 (1-8)	326.4	67.3	17.09
H12(1-12)	293.6	100.1	25.43

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	39.15	17.20	30.53
H4 (1-4)	33.55	4.36	11.50
H6 (1-6)	30.52	—3.76	—12.32
H8 (1-8)	19.76	0.00	0.00
H12(1-12)	14.93	—1.79	—11.99

C.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	2.19	—.46	—26.59
H4 (1-4)	1.38	.16	10.31
H6 (1-6)	1.75	—.44	—33.59
H8 (1-8)	1.28	—.07	—5.79
H12(1-12)	1.37	—.39	—39.80

D.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	3.39	—.51	—17.71
H4 (1-4)	1.80	.60	25.00
H6 (1-6)	3.53	—1.68	—90.81
H8 (1-8)	1.57	.03	1.88
H12(1-12)	2.03	—.69	—51.49

and eighth trials in a series of guided runs the subject has sufficiently mastered the true pathway to have eliminated, in large measure, the retracing habit. At any rate, the saving in return errors exhibited in the seventh and eighth trials is sufficient to balance, when the average return error per trial for the first eight trials is considered, the unfavorable effect of the fifth and sixth runs.

Should we accept the explanation just offered for the favorable influence of the seventh and eighth directed trials, we have the problem of the unfavorable influence of the ninth to the twelfth trials to consider. This we have suggested may be the result of explorations on the part of some of the subjects who, as soon as they feel themselves well oriented, set up as their next problem the detecting of some more obscure or hidden short route, rather than the tedious perfecting of a well-nigh perfect habit. The remarks of the subjects give the writer some faith in this interpretation of the results.

The subsequent effect of control upon the average number of cul-de-sac or return errors amassed per trial shows no consistent variation with the length of the period of guidance. If, however, we consider the average number of cul-de-sac errors made per trial by each of the groups in the trials after the sixteenth, a more consistent variation with amount of control is apparent. The influence upon the cul-de-sac errors is, in each case, unfavorable; but the degree of unfavorableness varies directly as the amount of guidance. The return error scores for the trials subsequent to the sixteenth show no such regular variation with the amount of control administered.

Influence upon time (Table 39) : The scores indicating the total time required to master the problem manifest, with one exception, small savings upon the normal. They exhibit, however, the same general pattern, as far as their relation to amount of control is concerned, as do the error scores.

The immediate effect is positive and greatest for the shortest and longest control periods. The large saving manifested in the trials from the ninth to the twelfth is significant, because in these trials we have an increase or, at least, no decrease in the return

TABLE 39. INFLUENCE UPON TIME OF VARIOUS AMOUNTS OF GUIDANCE IN THE INITIAL POSITION—HUMAN SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	1573.69	33.72	2.10
H4 (1-4)	1548.63	58.78	3.66
H6 (1-6)	1705.75	—98.34	—6.12
H8 (1-8)	1563.03	44.38	2.76
H12(1-12)	1426.78	180.63	11.24

B.

Group	Av.Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	199.85	50.40	20.14
H4 (1-4)	149.92	17.60	10.50
H6 (1-6)	136.74	—21.12	—18.27
H8 (1-8)	74.58	7.62	9.27
H12(1-12)	61.71	12.97	17.37

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (1-2)	35.84	—11.04	—44.52
H4 (1-4)	28.55	—5.55	—24.13
H6 (1-6)	27.27	—6.19	—29.36
H8 (1-8)	17.98	1.93	9.69
H12(1-12)	19.52	—1.60	—8.92

errors. Though returns may be increased, time is saved because of the prevention of cul-de-sac errors.

The time per trial in the post-control period is increased, generally speaking, but the relative increase becomes less as the length of the guided series increases. This relation between time and amount of guidance may be a direct result of the influence of the control upon the time or it may be a result of the increased number of trials and the consequent facility in traversing the maze acquired with increased practice. The latter hypothesis seems very

reasonable because the amount of loss in the time required per trial correlates well with the number of trials taken to master the maze.

2. *Influence of Various Amounts of Guidance Introduced upon the Fifth Trial*

Series of guided trials two and four runs in length were introduced upon the fifth trial.

TABLE 40. INFLUENCE UPON TRIALS OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE FIFTH TRIAL—HUMAN SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
H2 (5-6)	43.0	1.3	2.93
H4 (5-8)	43.7	.6	1.36

Influence upon trials (Table 40): Two and four directed runs interpolated at this critical intermediate stage of the learning are scarcely efficacious in reducing the number of trials required to master the maze. Considering, moreover, the variability in the trial scores, we do not seem justified in attempting an evaluation of the relative effectiveness of the two series.

Influence upon errors (Table 41): The relative efficacy of the two series of guided trials is, perhaps, more apparent in the realm of total errors. Control extending over two trials increases the total number of errors amassed before a mastery of the problem is attained, whereas four directed trials slightly reduce the number of errors.

The immediate effect of the guidance upon return errors is favorable in the case of both of the groups, although the absolute, as well as the relative, saving is greater for the group controlled for only two trials. This relation between the scores of the two groups is scarcely to be expected. It may, however, be accounted for in much the same way as the similar relation between the scores of the groups guided for the initial two and four trials. The turns in the true pathway may still have in the fifth and sixth,

TABLE 41. INFLUENCE UPON ERRORS OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE FIFTH TRIAL—HUMAN SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
H2 (5-6)	427.6	—33.9	—8.61
H4 (5-8)	378.5	15.2	3.86

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H2 (5-6)	9.68	1.94	16.84
H4 (5-8)	8.30	.67	7.47

C.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (5-6)	1.67	—.36	—27.48
H4 (5-8)	1.68	—.47	—38.84

D.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (5-6)	2.74	—.89	—48.11
H4 (5-8)	1.84	—.24	—15.00

as a result of the uncertainty produced by the alteration of cues, a sufficiently barrier-like action to prevent long retracings, whereas in the seventh and eighth runs increasing familiarity with the true pathway may tend to favor longer returns and, consequently, to produce a relatively higher error score.

The effect of the control upon the number of errors made per trial in the post-control period is decidedly deleterious. The short

series of directed runs has a more unfavorable effect upon return errors than upon cul-de-sac errors, while the reverse is true for the group guided for a longer time. Since in the case of the human subjects, four trials in this intermediate position is a sufficiently long period to permit the subject to develop some conscious dependence upon the cues from the controlling device, and since, moreover, the subject is not informed of the removal of the control, one might expect the abstraction of the guiding cues to instigate a search for the lost cues on the part of the subject and hence increase, to a relatively greater degree than would the two directed trials, the number of cul-de-sac errors amassed per trial in the post-control period. The result, on the other hand, may be a mere matter of chance.

Influence upon time (Table 42): Since the time scores reveal nothing significant, they will not be discussed.

TABLE 42. INFLUENCE UPON TIME OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE FIFTH TRIAL—HUMAN SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
H2 (5-6)	1759.48	—152.07	—9.46
H4 (5-8)	1597.22	10.19	.63

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H2 (5-6)	49.07	2.92	5.61
H4 (5-8)	42.17	3.63	7.09

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (5-6)	27.79	—6.71	—31.83
H4 (5-8)	22.90	—2.99	—15.02

3. *Influence of Various Amounts of Guidance Introduced upon the Seventh Trial*

The influence of a series of two and six directed trials introduced upon the seventh run will furnish the material for the discussion of this section.

TABLE 43. INFLUENCE UPON TRIALS OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE SEVENTH TRIAL—HUMAN SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
H2 (7-8)	41.1	3.2	7.22
H6 (7-12)	37.1	7.2	16.24

Influence upon trials (Table 43): Contrary to the findings up to this point, the longer of the two series reduces more markedly than the shorter the number of trials required to master the maze. Because of the small number of cases in each group, and because of our failure to provide a series of groups whose periods of guidance shall form a series of gradually increasing length, the results cannot be taken too seriously.

Influence upon errors (Table 44): The influence of two and six guided runs upon the total error scores is very slight. The two series of directed runs are about equally efficacious, when efficacy is measured in terms of the total number of errors made; but the manner in which the two series influence errors is very different. The immediate effect of the two-trial series upon return errors is decidedly unfavorable, whereas that of the six-trial series is markedly favorable. In the post-control period, on the other hand, while all error scores are increased above the normal in both of the groups, the longer series of controlled runs has a relatively more unfavorable effect upon cul-de-sac errors than does the short series. The reverse is true in the realm of return errors.

TABLE 44. INFLUENCE UPON ERRORS OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE SEVENTH TRIAL—HUMAN SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
H2 (7-8)	378.3	15.4	3.91
H6 (7-12)	380.3	13.4	3.40

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H2 (7-8)	8.72	—1.94	—28.61
H6 (7-12)	3.95	1.35	25.61

C.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (7-8)	1.29	—.08	—6.61
H6 (7-12)	1.16	—.18	—18.36

D.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (7-8)	2.06	—.46	—28.75
H6 (7-12)	1.45	—.11	—8.21

TABLE 45. INFLUENCE UPON TIME OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE SEVENTH TRIAL—HUMAN SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
H2 (7-8)	1587.92	19.49	1.21
H6 (7-12)	1571.79	35.62	2.22

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H2 (7-8)	38.42	2.52	6.22
H6 (7-12)	25.90	11.96	31.59

C.

Group	Av. Time per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (7-8)	19.22	.69	3.46
H6 (7-12)	22.48	—4.56	—25.45

Influence upon time (Table 45): The influence of each of the two series of directed runs upon the total time required to effect a mastery of the problem is practically negligible. This result is the outcome, however, of two or more antagonistic effects, rather than a lack of influence on the part of the control. The immediate effect of the longer series is markedly beneficial; its subsequent effect is decidedly detrimental. The short series, on the other hand, produces a slight saving in the time consumed per trial in both the control and post-control periods. The increase in time per trial for the trials of the post-control period exhibited by group H6 (7-12) may have little significance as an index of the influence of the control upon time, for this group displays a not inconsiderable saving in trials. Saving in trials, as we have so often indicated, operates to increase the time per trial above the normal through decreasing the practice an animal gets in running the maze.

4. *Influence of Various Amounts of Control Introduced upon the Ninth Trial*

The experiment was so arranged that series of two, four and eight directed trials were introduced upon the ninth run. The group guided for two runs we have referred to as H2 (9-10); that guided for four trials, as H4 (9-12); and the group controlled for eight trials, as H8 (9-16).

TABLE 46. INFLUENCE UPON TRIALS OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE NINTH TRIAL—HUMAN SUBJECTS

Group	Trials	Absolute Saving	Relative Saving (Per Cent)
H2 (9-10)	35.6	8.7	19.04
H4 (9-12)	37.5	6.8	15.35
H8 (9-16)	37.1	7.2	16.36

Influence upon trials (Table 46): Two, four and eight directed runs all operate to produce a reduction in the number of trials required to master the problem. No direct variation of the amount of benefit with the amount of control administered is apparent, however. Very little control seems slightly more beneficial than a great deal. Control in medium amounts is, on the other hand, less efficacious than more generous quantities.

A series of two directed trials probably operates to call attention to the critical elements of the situation, to suggest new possibilities without disrupting, to any degree, the old procedure. The four-trial series is, doubtless, sufficiently extended to indicate vaguely the proper method of procedure to the subject, and not sufficiently long to define it clearly. Removal of the control, then, is very likely to be disrupting because it initiates explorations aimed at the recovery of cues which are not again to be found. When the period of control is sufficiently extended, it permits the development of a rather clear definition of the situation and gives to the subject confidence in his conception of the proper path. The removal of the controlling device tends to be recognized as an alteration of the maze pattern which, the subject infers, has been

brought about by the experimenter. Hence he is not very much perturbed by the modification.

Influence upon errors (Table 47): The hypothesis just advanced is supported by both the error and time scores. Two and eight directed runs produce a saving in the total number of errors made; four controlled trials, on the other hand, are detrimental, so far as their effect upon total errors is concerned.

The number of return errors made per guided trial varies inversely as the number of the trials in the series. The immediate influence of the two and four-trial series is detrimental; eight controlled runs, on the other hand, effect, as an immediate result, a relatively large saving in return errors.

The introduction of the control and the consequent alteration of the cues in the ninth trial, when habits have become well established, is confusing. This confusion would naturally be at its maximum in the first two trials of the controlled series. By the third and fourth trials of the guided series the confusion has, to a large extent, disappeared and the total number of return errors made is reduced below the normal, but not sufficiently to counterbalance, when the average of the first four trials is taken, the increase in the return errors apparent in the first two trials. The fifth to the eighth trials of the guided series are characterized by a marked reduction below the normal of the return errors amassed per trial. This condition indicates that the absence of cul-de-sacs, after the subject becomes adapted to the altered situation, does operate to decrease the number of return errors that are made.

The subsequent effect of the guided series upon both the return and cul-de-sac errors amassed per trial in all three of the groups is unfavorable. The relative increase in the number of errors made per trial in the post-control period is least in the case of the group guided for two runs and greatest in the case of that group given four directed trials. One would expect that the more fixed the habit, *i.e.*, the longer the period of control, the more confusing the removal of the guiding device would be, but, as we have previously indicated, there is a possibility of emotional and ideational factors arising to favor slightly the long period of control as opposed to that of intermediate length.

TABLE 47. INFLUENCE UPON ERRORS OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE NINTH TRIAL—HUMAN SUBJECTS

A.

Group	Total Errors	Absolute Saving	Relative Saving (Per Cent)
H2 (9-10)	367.8	25.9	6.58
H4 (9-12)	417.6	—23.9	—6.07
H8 (9-16)	362.7	31.0	7.87

B.

Group	Av. No. of Return Errors per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H2 (9-10)	9.57	—5.82	—155.20
H4 (9-12)	5.81	—1.06	—22.23
H8 (9-16)	1.70	1.81	51.57

C.

Group	Av. No. of Cul-de-sac Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (9-10)	1.36	—.18	—15.25
H4 (9-12)	1.63	—.65	—66.32
H8 (9-16)	1.03	—.24	—30.38

D.

Group	Av. No. of Return Errors per Trial for Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (9-10)	1.75	—.41	—30.59
H4 (9-12)	2.92	—1.58	—117.91
H8 (9-16)	2.16	—.86	—66.15

Influence upon time (Table 48): The time scores reveal few tendencies that are not apparent in the error scores. Group H2 (9-10) exhibits a considerably greater saving in the total time consumed in the learning of the maze, as contrasted with

TABLE 48. INFLUENCE UPON TIME OF VARIOUS AMOUNTS OF GUIDANCE INTRODUCED UPON THE NINTH TRIAL—HUMAN SUBJECTS

A.

Group	Total Time	Absolute Saving	Relative Saving (Per Cent)
H2 (9-10)	1389.19	218.22	13.57
H4 (9-12)	1566.48	40.93	2.57
H8 (9-16)	1554.15	63.26	3.94

B.

Group	Av. Time per Directed Trial	Absolute Saving	Relative Saving (Per Cent)
H2 (9-10)	41.07	—9.42	—29.76
H4 (9-12)	32.73	3.46	9.57
H8 (9-16)	24.31	5.68	18.94

C.

Group	Av. Time per Trial For Trials Subsequent to Control	Absolute Saving	Relative Saving (Per Cent)
H2 (9-10)	20.43	—1.63	—8.67
H4 (9-12)	21.77	—3.85	—21.48
H8 (9-16)	21.21	—4.52	—27.08

groups H4 (9-12) and H8 (9-16), than the error scores would lead one to suspect. The relative increase, furthermore, in the time required per trial in the post-control period varies directly as the amount of guidance granted. This tendency is also somewhat surprising in view of the error scores. The results are not out of keeping, however, with the hypothesis set forth in the previous paragraph. One would expect the individual who rather clearly recognizes the alteration of the maze when the controlling device is removed and believes, perhaps, that he is being tricked, to be slow and deliberate in his movements.

SUMMARY

A. Results of Experimentation upon Animals:

1. The efficacy of control is a function of the amount administered.

2. When guidance is given in the early trials, its efficacy increases as the number of directed runs is increased up to a certain optimum number. If the length of the guided series is further extended, the efficacy of the control decreases. This tendency is manifested in the scores indicating the trials required, the total errors made, and the total time consumed, as well as the errors made per trial and time required per trial in the post-control period.

The optimum amount of guidance is probably that which permits a fairly clearly defined habit to develop, but terminates when the habit is still sufficiently plastic to allow a ready substitution of new cues as stimuli for the proper responses.

3. In the early trials of a controlled series the immediate influence of guidance upon the number of return errors made per trial is unfavorable. In the later trials of the series, however, the prevention of cul-de-sacs operates to reduce far below the normal the number of retracings.

The probable explanation for this fact has been indicated in the body of the present chapter, as well as in the summary of the preceding.

4. Of four and eight directed trials interpolated upon the fifth run, eight trials are, in general, the more efficacious. The immediate effect of the four-trial series upon the time consumed per trial, and the immediate, as well as subsequent, effect of the same series upon the number of return errors amassed per trial, is, however, more favorable than that of the eight-trial series. No great reliance, however, can be placed upon these results.

B. Results of Experimentation upon Human Subjects:

1. The efficacy of control varies with the amount administered.

2. The relative effectiveness of various amounts of guidance is a function of the position in the learning process at which the control is interpolated.

3. In the early and late stages of the learning, the very short or very long periods of the control are more efficacious than the periods of medium length. This relation is apparent when efficacy is measured in terms of the number of trials required or the total errors made or the total time consumed. The control period must either be so short that it merely calls attention in a vague way to the critical elements of the situation without markedly disrupting the old procedure, or so long that it permits the development of a rather clear conception of the true pathway and an attendant confidence.

4. Upon the relative efficacy of various amounts of control interpolated in an intermediate position in the sequence of trials, no generalization can be made.

5. When guidance is given in the early stages of the learning, its immediate effect upon return errors is favorable, if the period of control is short; unfavorable, if the period of control is long. The reverse is true, when the series of controlled trials is interpolated later in the learning.

The probable explanation of the relation between the number of return errors made per directed trial to the length of the period of control, when the guidance is given in the early stages of the learning, has been indicated in the summary of the preceding chapter.

When the directed trials are interpolated later in the learning, the alteration of cues attendant upon the introduction of the controlling device causes confusion and much retracing. This confusion is easily overcome if the period of control is extended; and then the absence of cul-de-sacs favors a rapid mastery of the simple pathway with a consequent marked reduction in the return errors.

6. No generalization can be made concerning the relative subsequent effect upon errors of various amounts of control.

7. When the guidance occurs at any but the earliest period of the learning, the saving in time per directed trial varies directly with the amount of control given. The reverse relation holds between the time consumed per trial in the post-control period and the amount of guidance.

8. In the case of guided series occurring very early in the trial sequence, the immediate effect of little or much control upon the average time required per trial is favorable; that of a medium amount, unfavorable. The subsequent effect upon the time required per trial of various amounts of control in the initial position is, generally speaking, deleterious. The degree to which the time per trial is increased above the normal varies inversely with the amount of control. This latter relation may be an indirect result of the influence of control upon trials, rather than the direct outcome of its action upon time. In the degree to which control reduces the number of trials required, it decreases the length of the practice period, and hence, perhaps, the general facility with which the problem is handled.

9. The results obtained in the experiment upon human and animal subjects are in most respects opposite. The divergence may be a consequence of the species difference, a difference in the distribution of the effort, or some other unavoidable variation in the procedure of the two experiments. The reason for the difference needs further investigation.

IV

THE INFLUENCE OF CONTROL UPON RETENTION

It has been a popular belief that responses developed by one's own unaided efforts are more thoroughly integrated into his action systems than those developed under guidance; that what one learns without aid, he retains best. The doctrine has accumulated considerable weight because of its relation to certain moral principles, as well as because of the absence of any definite contradictory evidence. No experimental studies which would cast light upon the validity of the belief have been reported. Hence our investigation of the problem, though neither elaborate nor extensive, should have at least suggestive value.

Our inquiry was limited merely to a consideration of the influence of guidance upon the retention of a motor habit by human subjects. Retention, moreover, was measured in terms of the number of errors made and the time consumed in a single tracing of the maze forty-eight hours after the problem had been mastered. No attempt was made to trace the influence of guidance upon the course of the disintegration of the habit.

The results (see Tables 49 and 50) of our investigation indicate that guidance does influence the retention of a motor habit. Under certain conditions the effect of control is favorable; under others, detrimental. The efficacy of the directed runs is determined, in part at least, by the number employed and the position at which they are interpolated in the learning period. It is evident from Table 49 that the accuracy with which the habit functions after a lapse of forty-eight hours varies, generally speaking, inversely as the distance of the period of guidance from the beginning of the learning. Control interpolated in the early stages of the learning period tends to decrease below the normal the number of errors made in the retention test, whereas guidance given in the trials subsequent to the sixth is unfavorable in its influence upon error. No very consistent relation, on the other hand, is apparent be-

tween the time consumed in the test for retention and the position in the learning at which the guided effort occurs.

TABLE 49. TOTAL NUMBER OF ERRORS MADE IN THE RETENTION TEST

No. of Directed Trials in the Learning Period	Trial upon Which the Controlled Series is Introduced					
	1	3	5	7	9	11
2	1.0	2.7	2.4	4.3	5.1	4.8
4	2.1		2.8		.8	
6	2.4			9.1		
8	1.4				4.6	
12	3.1					
Error Score of Normal Group	3.5	3.5	3.5	3.5	3.5	3.5

TABLE 50. TOTAL TIME CONSUMED IN THE RETENTION TEST

No. of Directed Trials in the Learning Period	Trial upon Which the Controlled Series is Introduced					
	1	3	5	7	9	11
2	28.0	21.0	19.9	21.9	31.4	22.0
4	24.4		17.6		18.8	
6	19.7			27.7		
8	21.0				31.1	
12	18.6					
Time Score of Normal Group	26.1	26.1	26.1	26.1	26.1	26.1

Among the groups in which the period of controlled learning began before the ninth trial, the number of errors accumulated in the test for retention tends to vary directly as the amount of guidance administered. The time consumed in the retention test by the groups which were guided early in the learning period tends to vary, on the contrary, inversely as the number of directed trials.

The relation between the effect of guidance upon learning and its effect upon retention is suggested by the correlations in Tables 51 and 52. The influence of two guided trials upon the number of errors accumulated in the learning period tends, in a general way,

TABLE 51. CORRELATIONS BETWEEN THE RANK OF INDIVIDUALS IN TERMS OF ERRORS MADE IN THE LEARNING WITH THE RANK IN TERMS OF ERRORS MADE IN THE RETENTION TEST[1]

No. of Guided Trials in the Learning Period	Trial upon Which the Guided Series is Introduced					
	1	3	5	7	9	11
2	—.37	—.14	+.31	—.39	—.50	—.01
4	+.40		+.25		+.48	
6	+.69			+.66		
8	+.71				—.21	
12	+.60					
Correlation in Case of Normal Group	+.15					

[1] All correlations reported in this monograph are based upon Spearman's formula:

$$\rho = 1 - \frac{6 \Sigma D^2}{N (N^2 - 1)}$$

to be the reverse of its influence upon the number of errors made in the retention test. The correlation between the quantities just indicated are negative and, though small, are rather consistently larger than the correlation between the same quantities in the normal group. In the case of the groups controlled for a period extending over more than two trials, the correlation between the number of errors made in the learning period and that made in the retention test is, as a rule, positive. As the amount of initial guidance is increased, the size of the correlation between the quantities in question increases.

In the case of the groups guided at an early stage of the learning the correlation between the time required for attaining a mastery of the problem and the time consumed in the retention test is positive and decreases in size as the length of the period of control is extended. Control, on the other hand, introduced upon the ninth trial or beyond, produces a negative correlation between the learning time and the time required in the retention test. Guidance in an intermediate position and not too limited in amount gives rise to a positive correlation between the two quantities under discussion.

TABLE 52. CORRELATION BETWEEN THE RANK OF INDIVIDUALS IN TERMS OF THE TIME CONSUMED IN THE LEARNING PERIOD WITH THE RANK IN TERMS OF THE TIME REQUIRED IN THE RETENTION TEST

No. of Directed Trials in the Learning Period	Trial upon Which the Guided Series is Introduced					
	1	3	5	7	9	11
2	+.59	—.58	+.58	—.40	—.29	—.23
4	+.22		+.32		—.36	
6	+.56			+.76		
8	+.48				—.23	
12	+.25					
Correlation in Case of Normal Group	+.13					

The correlation between the trial scores of the various groups and the error or time scores in the retention test do not deviate sufficiently from the normal nor exhibit sufficient regularity to justify any generalizations.

The mechanism by which control influences the retention of the maze habit is not entirely obvious. Several possible hypotheses in regard to this mechanism suggest themselves; but they are largely *a priori* in character and are offered only for what they are worth. In so far as the control prevents the formation of false habits, it should react favorably upon retention, for as the maze habit disintegrates and the organized proper response is no longer powerfully dominant, it is less probable that false reactions will occur in the test for retention, if they have never been experienced, than if the subject has frequently indulged in them. This error-preventing capacity of the control is greatest when the period of guidance occurs in the early stage of the learning, because it is in this stage that elaborate explorations prevail. Hence, one would expect guidance in the early trials to act most favorably upon retention. This our results indicate to be the case.

The hypothesis just advanced may, furthermore, account in part for the rather consistently positive correlations between the error scores for the learning period of the groups given initial guidance, and their error scores in the retention tests.

Control not only operates to prevent the formation of some improper habits, but it may establish a dependence upon false cues. To the extent to which guidance does result in the formation of two modes of response to many elements of the maze situation, and to the extent that these are conflicting, in part, at least, it is probable that control may have a deleterious action. If the habit has disintegrated far enough to weaken or destroy the dominance of the organized response not dependent upon the controlling device for cues, or the dominance of a concept of the relations of the various parts of the maze, a conflict of tendencies may result with a consequent increase in the error score of the retention test. Such a mode of functioning on the part of the control may account for the direct relation between the number of errors accumulated in the test for retention and the amount of guidance given in the learning period, as well as the detrimental effect upon retention of the directed runs introduced in the later stages of the learning.

The favorable influence of the longer period of control upon the time consumed in the retention test may be the result of a general speed set determined early in the period in which the habit is being acquired, by the simplicity of the task of mastering the cul-de-sac-less maze and the consequent confidence in ability to succeed.

V

THE INFLUENCE OF GUIDED LEARNING UPON THE ADAPTABILITY OF THE LEARNED REACTION

The adaptability of the reaction established with the aid of guidance was tested by having each subject trace the maze under a series of nine distracting conditions, forty-eight hours after he had mastered the problem. The distractions employed were: a shifting of the position of the maze through 90, 180 and 270 degrees, respectively; the silent recitation of the first stanza of "Mary had a little lamb"; reading aloud from a scientific text; drawing triangles with the left hand; tracing the maze with the left hand; traversing it from goal to entrance; and lastly, while tracing the maze with the left hand, drawing triangles with the right. The distractions were given in the indicated order. One trial only under each of the conditions was allowed. In those tests characterized by a modification in the position of the maze, the subject had no knowledge of the alteration.

The results of these tests are given in Tables 53 to 61. Both error and time records were taken, but since both exhibit the same tendencies, only the results based upon the error records are presented in the tables.

An inspection of the data reveals the fact that guidance sometimes increases and sometimes decreases the adaptability of the maze habit. The nature and degree of the influence of control is apparently a function of three interrelated conditions:

(1) *Amount of guidance*: In the test, for example, in which the maze is traversed with the right hand while the left is engaged in drawing triangles, the effect of initial guidance is invariably deleterious and the degree of detriment varies directly with the amount of control given.

As the period of guidance introduced upon the ninth run is extended from two to eight trials, the effect upon the adaptability of

the learned reaction to the 180 degree shift in the position of the maze becomes increasingly unfavorable.

Various amounts of initial guidance have a similar influence upon the adaptability of the reaction to the conditions of the tests in which the maze is traversed while the subject silently recites a jingle, or while he reads aloud, as well as that in which the position of the maze is shifted 90 degrees. The effect of the initial two trials is somewhat deleterious; four trials are distinctly favorable; while as the number of guided trials is extended from four to twelve, the influence becomes increasingly less favorable or more unfavorable.

These illustrations serve merely to demonstrate that the adaptability of the maze reaction to altered conditions is a function of the amount of guidance given in the learning period. The particular relations that obtain, however, between the amount of control and its effect upon the adaptability of the habit is conditioned by the position in the learning at which the given amount is interpolated, as well as the situation to which the habit must be adjusted. Four guided trials, for example, in the initial position increase above the normal the errors made in the test in which the maze is shifted 180 degrees, whereas they act to reduce the number of errors accumulated in the test characterized by silent recitation or reading aloud.

(2) *Position of guidance*: The adaptability of the reaction in the case of the groups controlled for four trials varies inversely, in seven of the tests, as the distance of the period of guidance from the initial trial. Under most of the other conditions presented by the tests, the influence of the position of the guided learning is less regular in its manifestations.

(3) *Nature of the problem*: There are some problems to which the reaction mastered with the aid of guidance is almost invariably adapted with more difficulty than that learned without guidance; other problems in which the reverse is true. The test in which the maze is traversed from the goal back to the entrance, as well as that in which one hand draws triangles while the other traces the maze, are examples of the former type. The test characterized by silent recitation or guiding the stylus with the left hand are exam-

ples of the latter type. The general characteristics of the two types of problem are not apparent. In fact, any functional classification of the problems that can be made must be so elastic it loses all significance.

It has, doubtless, occurred to the reader that probably some of the problems do not test the adaptability of the reaction at all, but rather the stability of the habit under distraction. The tasks which one would set apart on *a priori* grounds as tests of the stability of the habit are those in which the subject traverses the maze while silently reciting a jingle, while reading aloud, or while his left hand is engaged in drawing triangles. If these problems actually test the stability of the reaction, one would be justified in expecting guidance to influence the performance of the tasks in a manner similar to that in which it influenced performance in the retention test. The results of these three tests do not, however, exhibit any higher or more consistent correlations with the results of the retention test than are manifested by some of the other more distinctly adaptive problems. The correlation, furthermore, of the results of the three tests with the results in the learning period do not vary in the same way with the manner in which guidance is employed, as do the correlations between the results of the learning and retention tests. Hence, a classification of the problems on the basis of the degree to which they test stability or adaptability seems unwarranted.

The great complexity of the conditions resulting from the interaction of the three dependent variables—the nature of the problem, the amount of guidance and its position—renders impossible, at present, the prediction of the effect of any single factor, as well as any intelligent explanation of the results.

TABLE 53. SCORES REPRESENTING THE INFLUENCE OF GUIDANCE UPON THE NUMBER OF ERRORS MADE IN THE DISTRACTION TEST CHARACTERIZED BY A ROTATION OF THE POSITION OF THE MAZE THROUGH 90 DEGREES

No. of Directed Trials in the Learning Period	Trial upon Which the Controlled Series is Introduced					
	1	3	5	7	9	11
2	28.1	51.8	93.9	94.7	36.1	59.3
4	13.2		41.3		47.3	
6	19.7			43.0		
8	28.0				26.5	
12	84.7					
Error Score of Normal Group	22.9	22.9	22.9	22.9	22.9	22.9

TABLE 54. SCORES REPRESENTING THE INFLUENCE OF GUIDANCE UPON THE NUMBER OF ERRORS MADE IN THE DISTRACTION TEST CHARACTERIZED BY A ROTATION OF THE POSITION OF THE MAZE THROUGH 180 DEGREES

No. of Directed Trials in the Learning Period	Trial upon Which the Guided Series is Introduced					
	1	3	5	7	9	11
2	32.8	16.2	11.1	15.5	20.5	27.8
4	11.3		15.0		25.4	
6	19.5			7.5		
8	12.8				30.0	
12	136.6					
Error Score of Normal Group	18.0	18.0	18.0	18.0	18.0	18.0

TABLE 55. SCORES REPRESENTING THE INFLUENCE OF GUIDANCE UPON THE NUMBER OF ERRORS MADE IN THE DISTRACTION TEST CHARACTERIZED BY A ROTATION OF THE POSITION OF THE MAZE THROUGH 270 DEGREES

No. of Directed Trials in the Learning Period	Trial upon Which the Guided Series is Introduced					
	1	3	5	7	9	11
2	14.0	21.9	35.9	19.9	4.2	5.9
4	12.8		18.9		96.4	
6	7.3			15.4		
8	10.9				18.1	
12	44.8					
Error Score of Normal Group	12.8	12.8	12.8	12.8	12.8	12.8

TABLE 56. SCORES REPRESENTING THE INFLUENCE OF GUIDANCE UPON THE NUMBER OF ERRORS MADE IN THE DISTRACTION TEST CHARACTERIZED BY SILENT RECITATION

No. of Directed Trials in the Learning Period	Trial upon Which the Guided Series is Introduced					
	1	3	5	7	9	11
2	7.5	1.6	1.8	7.1	1.2	1.6
4	2.2		7.2		38.4	
6	3.2			2.2		
8	5.7				8.1	
12	34.4					
Error Score of Normal Group	3.9	3.9	3.9	3.9	3.9	3.9

TABLE 57. SCORES REPRESENTING THE INFLUENCE OF GUIDANCE UPON THE NUMBER OF ERRORS MADE IN THE DISTRACTION TEST CHARACTERIZED BY READING ALOUD

No. of Directed Trials in the Learning Period	Trial upon Which the Guided Series is Introduced					
	1	3	5	7	9	11
2	9.7	5.4	1.9	3.7	6.4	4.7
4	1.0		8.8		11.6	
6	5.1			9.8		
8	9.8				1.2	
12	13.3					
Error Score of Normal Group	1.9	1.9	1.9	1.9	1.9	1.9

TABLE 58. SCORES REPRESENTING THE INFLUENCE OF GUIDANCE UPON THE NUMBER OF ERRORS MADE IN THE DISTRACTION TEST CHARACTERIZED BY TRAVERSING THE MAZE FROM THE GOAL BACK TO THE BEGINNING

No. of Directed Trials in the Learning Period	Trial upon Which the Guided Series is Introduced					
	1	3	5	7	9	11
2	12.6	11.7	8.6	10.0	20.7	7.9
4	15.1		54.8		70.0	
6	12.0			4.4		
8	10.3				11.1	
12	10.2					
Error Score of Normal Group	7.1	7.1	7.1	7.1	7.1	7.1

TABLE 59. SCORES REPRESENTING THE INFLUENCE OF GUIDANCE UPON THE NUMBER OF ERRORS MADE IN THE DISTRACTION TEST CHARACTERIZED BY THE TRAVERSING OF THE MAZE WITH THE LEFT HAND

No. of Directed Trials in the Learning Period	Trial upon Which the Guided Series is Introduced					
	1	3	5	7	9	11
2	7.8	11.7	5.1	4.2	2.4	14.4
4	4.8		3.3		32.0	
6	7.5			2.1		
8	3.9				4.7	
12	14.4					
Error Score of Normal Group	5.3	5.3	5.3	5.3	5.3	5.3

TABLE 60. SCORE REPRESENTING THE INFLUENCE OF GUIDANCE UPON THE NUMBER OF ERRORS MADE IN THE DISTRACTION TEST CHARACTERIZED BY DRAWING TRIANGLES WITH THE LEFT HAND

No. of Directed Trials in the Learning Period	Trial upon Which the Guided Series is Introduced					
	1	3	5	7	9	11
2	12.7	14.2	5.3	9.6	14.3	8.2
4	23.1		23.6		67.8	
6	26.5			9.7		
8	41.3				33.1	
12	42.7					
Error Score of Normal Group	5.3	5.3	5.3	5.3	5.3	5.3

TABLE 61. SCORES REPRESENTING THE INFLUENCE OF GUIDANCE UPON THE NUMBER OF ERRORS MADE IN THE DISTRACTION TEST CHARACTERIZED BY DRAWING TRIANGLES WITH THE RIGHT HAND, WHILE THE LEFT HAND TRAVERSES THE MAZE

No. of Directed Trials in the Learning Period	Trial upon Which the Guided Series is Introduced					
	1	3	5	7	9	11
2	65.6	19.3	40.8	8.7	11.3	26.4
4	18.3		40.4		13.6	
6	34.9			4.4		
8	24.3				10.9	
12	20.7					
Error Score of Normal Group	9.6	9.6	9.6	9.6	9.6	9.6

VI

GENERAL SUMMARY

The discussion of the present chapter contains no new contribution to the material of the investigation. It presents briefly the general results of the study and the concepts which have been of value in the systematization of the facts. The hypotheses are submitted with no claim for their completeness as explanatory principles for the phenomena described, nor for their finality.

1. Influence of Control upon Learning

A. Factors Influential in Determining the Effect of Control upon Learning.

1. *Type of problem*: The present investigation, considered in conjunction with that reported by Carr and Koch,[1] reveals that the effectiveness of guidance is a function of the type of problem in which it is employed. Control in the alternation problem was deleterious in its effects, generally speaking, although there were apparently cases of great individual benefit. In the maze problem, on the contrary, the influence of control, in the case of the rats, is very beneficial. The two problems differ, in that the mastery of the maze involves primarily the elimination of excessive movements, whereas in the alternation problem, the acquisition of a type of response quite foreign to the animal constitutes the burden of the task.

2. *Species differences*: The results of the two experiments in which men and animals served as subjects diverge widely. Whether this divergence is dependent wholly upon species differences, upon the distribution of the effort, or upon other uncontrolled factors in the situations, it is not our privilege to say. We have merely the fact to offer that the control was very efficacious under the conditions maintained in the experiment conducted upon rats;

[1] *Op. cit.*

less efficacious, and at times even detrimental, in the experiment upon human subjects.

3. *Position of the control*: In the case of the animals, the degree of benefit derived from control administered somewhere within the first sixteen trials, varies inversely as the distance of the period of guidance from the beginning of the learning. The efficacy of the control, in the case of the human subjects, on the other hand, tends to vary directly as the distance (within limits) of the series of guided runs from the initial trial.

4. *Amount of control*: The efficacy of a given amount of guidance, according to our results, is a function of the period in the learning process at which the directed runs are interpolated. The relative influence of various amounts of guidance, furthermore, is not the same in the experiments conducted upon human and animal subjects. Hence, no broad generalization can be made concerning the optimum number of directed trials. It is worthy of note, however, that the relation between the amount and the efficacy of the control is no simple straight line relation. The modes of functioning of the control are many and often antagonistic. Little and much guidance in a given position, for instance, may be very effective, and effective in like degree, whereas a medium amount is of limited value. For another position, there may be an optimum amount of control which, if increased or decreased, causes a diminution in the efficacy of the guided effort.

B. Possible Modes in Which the Control may Function.

1. The closing of the blind alleys in the initial stage of the learning prevents the formation of habits of entering cul-de-sacs at a time when, under normal conditions, these habits are most readily acquired. The benefit derived from this particular mode of functioning on the part of the control is, probably, greatest in the very early trials, when the reaction to the maze situation is most diffuse, and is much reduced as soon as the reaction loses its rambling character. It is possible that the prevention of errors accounts in large measure for the great efficacy of initial guidance in the case of the rats whose learning proceeds, presumably, on a sensori-motor level. It may not be so efficacious in its influence

upon the human subjects whose learning is conceptual, in part at least. Learning what not to do may be of quite as much value to them as learning what to do.

2. In the very early trials, when the maze path is unfamiliar and retracings abundant, cul-de-sacs may act as barriers and prevent returns over any great part of the path. Consequently, one would expect the blocking of the blind alleys in the initial stage of the learning to favor long retracings and a resultant high error score. Such is the case with the animals; but the human subjects, quite contrarily, make fewer return errors in the first four trials when guided than when uncontrolled.

The turns in the true path of the small stylus maze prevent long returns in the very early stages of the learning. The simplification of the maze pattern, through the closing off of the blind alleys, also tends to decrease the retracings. Hence, in the early runs, the guided groups of human subjects make fewer errors than does the unguided group. As soon, however, as familiarity with the pathway is attained and the turns no longer act as barriers, a temporary accentuation of the retracing habit occurs, just as it did in the case of the animals in the early trials.

In the later stages of the learning, when the tendency to retrace is not very prominent, except as it is prompted by entrances into the cul-de-sacs, we should expect the prevention of cul-de-sac errors to greatly reduce the number of return errors made. This is probably the explanation of the reduction in the number of retracings which characterizes the later trials of the long periods of either initial or interpolated control.

The increase in the return errors accumulated in the initial trials of a period of interpolated guidance can be accounted for in terms of conflict and confusion. The introduction of the controlling device alters cues—especially if the guidance is interpolated later in the learning period—upon which the subject has come to depend, and thus temporarily disrupts the reaction.

3. The simplification of the maze pattern, particularly in the initial stages of the learning, may react upon the attitude of the subject toward the problem. Though we have no reason to doubt the influence of attitudinal factors in the learning of the animals,

we can speculate with confidence only in regard to their reaction upon the human subjects. The following are a few of the numerous possible ways in which the control may influence learning through the general set it provokes. The relative simplicity of the task of tracing the cul-de-sac-less maze, for example, may establish confidence on the part of the subject in his ability to master the problem, which in turn may increase his interest and serve as a goal to augment his effort. It is, on the other hand, not improbable that confidence will lead to carelessness or non-plasticity in the post-control period. Confidence established in the period of control may, moreover, act only to accentuate the discouragement which often attends the discovery of the cul-de-sacs in the post-control period.

It is not our intention to make a complete catalogue of the particular phase of the control's influence conditioned by the set it excites. Concerning the method, furthermore, whereby attitude influences learning, as well as the degree to which the attitude is conditioned by the manner in which the control is employed, we have no constructive suggestions to offer. We wish merely to suggest the factor as one that must be reckoned with in a complete description of the effect of guidance upon learning.

4. The control, to the extent to which it simplifies the maze pattern, may facilitate the formation, on the part of the human subject, of an accurate concept of the positional relations of the various parts of the true path. This mode of functioning is, presumably, influential in the case of initial and interpolated guidance and increases as the period of control is extended up to a certain point. It must be remembered, however, that the concept formed during the longer periods of initial guidance must undergo considerable remodelling when the subject is brought in contact with the cul-de-sacs in the post-control period. If, however, the control is interpolated later in the learning, it may facilitate the formation of a concept which includes not only the notion of what is the true path, but what is the false. This contrasting of the true path with the blind alleys through the aid of properly interpolated guidance may be one of the reasons why, in the case of the human

subjects, the efficacy of the control varies, in general, directly as the distance of the period of control from the initial trial.

5. Guidance, whether initial or interpolated, may act to facilitate the substitution of proper conceptual as well as sensory stimuli for releasing the desired responses. A human subject, for instance, may readily learn that catching his stylus in the notches in the wall produced by the guiding device, is not necessary and that the desired forward progress is made if he follows closely the opposite wall or runs the stylus swiftly down the path, until a certain turn is reached. The elimination of the habit of entering a cul-de-sac is much more difficult than making the substitution just described. The cul-de-sac may not be recognized as such for a long time. Even if the character of the blind alley is known, it is frequently difficult to overcome the tendency to make a slight excursion into the mouth of the alley before progressing forward. The process of overcoming the impulse to enter the cul-de-sac is often in its very last stages similar to the process of releasing oneself from dependence upon the notch as a cue for proceeding forward.

This facilitation of the formation of the proper reaction to a substituted stimulus which is not conditioned by the controlling device is a factor which, presumably, increases as the amount of control is increased. One would expect it to be operative in the case of both human and animal subjects.

6. Interpolated guidance may call attention to cul-de-sacs which were not, previous to the period of control, recognized as such. It is no uncommon occurrence for a human subject to enter a blind alley regularly for a long time without being aware of his uneconomical procedure. Control, though limited in amount, leads to the ready elimination of such an error.

7. The alteration of cues attendant upon the introduction and removal of the controlling device may be very distracting. If the cues have been thoroughly integrated into the subject's action system, the alteration of them may entice him into cul-de-sacs and cause much vain wandering. Short periods of initial guidance and control interpolated early in the learning period, however, do not have so disturbing a subsequent influence.

The alteration of cues necessitates, in the case of the human sub-

ject, a reorganization of his concept of the maze, as well as a reorganization of simple kinaesthetic- or tactual-motor habits. The elimination, for example, of landmarks such as the notches in the wall (as the entrances to the blocked alleys are known to the subjects) may disrupt the whole sequence of reactions, and cause elaborate analyses of the difficulty. The subject may instigate a systematic search for the lost cues which are never to be recovered. Long wanderings may occur which afford opportunity for the formation of many undesirable habits. Such a type of response to the modifications in the situation one might expect to occur, when the period of control has been rather extended and the cues from the guiding device explicitly recognized.

8. Control, if considerable in amount, and especially if interpolated rather late in the learning, may result in the formation of two types of reaction, of about equal strength, to a particular phase of the situation. A disrupting conflict of habits may be the consequence. One would expect this effect of control to be greater in the case of the animal than in the case of the human subjects.

9. The simplification of the task during the period of control often results, if the number of guided trials has been large, in the establishment of a rather high speed set which prevails throughout the rest of the learning.

2. Influence of Control upon Retention

A. Factors Influential in Determining the Effect of Control upon Retention.

1. *Position of the guided effort*: Control introduced early in the learning period (within the first six trials) is an aid to retention, whereas that occurring in the latter part of the first sixteen runs is unfavorable in its influence. The degree to which an accurate response to the maze situation is retained varies, generally speaking, inversely as the distance from the initial trial in the learning period at which the controlled runs are interpolated. The reader should not, however, be unmindful of the fact that retention was measured by the number of errors made and the time consumed in a single tracing of the maze forty-eight hours after a mastery of the problem had been attained. A different mode of

measurement—that of relearning, for instance—or a consideration of the results at a different stage of the disintegration of the habit might not reveal the existence of the same relations between the relative degree to which the maze habit is retained by the various guided groups.

2. *Amount of guidance*: Barring from consideration the cases of guidance introduced rather late in the learning period, we observe that the accuracy with which the maze habit functions after a forty-eight-hour interval of rest varies inversely as the amount of control given, whereas the speed with which the habit runs itself off tends to vary directly as the number of directed trials employed in the learning. No consistent relation is apparent between the degree of retention, as measured either in terms of errors or time, or the number of guided runs, when these are interpolated rather late in the learning period.

B. The Relation of the Influence of Guidance upon Learning and Retention.

The correlation between the influence of guidance on learning and retention is, as a rule, rather small. It may be positive or negative, depending on the number and position of the guided trials. A small amount of interpolated guidance usually results in a negative correlation. Initial guidance, on the other hand, generally produces a positive correlation. The size of the correlation between the error scores of the learning period and retention test increases as the amount of initial guidance is increased, whereas the correlation between the time consumed in the learning and that required in the retention test decreases as the period of initial guidance is extended.

C. Possible Modes in Which Controlled Learning may Influence Retention.

1. Control in the learning period may act to prevent contact with certain error situations. The reaction of this mode of functioning upon the retention of the proper habit would probably be favorable. The usual false reactions, whose formation in the learning period the control prevented, are not so likely to occur

when the habit functions after a lapse of time, as they would had the subject frequently indulged in them and eliminated them with effort. This reaction of controlled learning upon retention one would expect to find most marked in those groups of subjects whose period of guidance occurred when the opportunities for the prevention of false reactions were most abundant; namely, in the early trials of the learning period.

2. Controlled learning may lead to the formation of conflicting habits in response to certain elements of the maze situation. The proper response must, to be sure, attain a slight dominance in the learning period; but after the habit has had occasion to disintegrate somewhat, this dominance may be destroyed and the conflict renewed with the consequent appearance in the retention test of a large number of errors. Such a mode of reaction upon retention would be most prominent when the period of controlled learning has been rather extended or has occurred late in the acquisition of the maze habit.

3. Influence of Control upon the Adaptability of the Habit

The adaptability of the maze habit formed with the aid of guidance is conditioned by three interrelated factors; namely, the amount of guidance given, the position in the learning period at which the control occurs, and the nature of the altered situation to which the habit must be adjusted. On the basis of our results no generally applicable statement can be made concerning the influence of any one single factor.